1 Reproduction in Lower and Higher Plants

Contents and Concepts

1.0 Introduction

Q.1.

i. Can you recall? *(Textbook page no. 01)*

a. How do plants reproduce without seeds?

Ans: Plants reproduce without seeds by vegetative propagation.

b. How does vegetative propagation occur in nature?

Ans: Vegetative propagation occurs with the help of vegetative organs like root, stem, leaf or bud.

ii. Why reproduction is an essential process?

Ans: Reproduction is an essential process as it leads to continuation of species as well as to maintain the continuity of life.

1.1 Asexual Reproduction

Q.2. What is reproduction? Name the two methods of reproduction.

Ans:

i. Reproduction is the ability of living beings (organisms) to give rise to young ones of their own kind.

ii. Two methods of reproduction: Asexual reproduction and Sexual reproduction.

Q.3. Define clones.

Ans: Morphologically and genetically identical individuals produced by asexual reproduction are called clones.

Q.4. Write a short note on asexual reproduction in lower organisms.

Ans:

i. **Asexual reproduction:**

It is a process of reproduction which results in production of genetically identical progeny from a single organism and inherits the gene of the parent.

ii. Asexual reproduction in lower organisms occurs by following methods:

a. **Fragmentation:**

Multicellular organisms break into fragments and each fragment can develop into new individuals. It occurs in *Spirogyra*.

b. **Budding:**

It is a common method of reproduction in unicellular organisms like yeast. Under favourable conditions one or more outgrowths (buds) are formed on parent cell. These buds on separation develop into new individual.

c. **Spore formation:**

It occurs in *Chlamydomonas*. In this, flagellated, motile zoospores are formed which grow independently into new individuals.

d. **Binary fission:** It occurs in *Amoeba*, *Paramoecium*

e. **Conidia formation:** It occurs in *Penicillium*

f. **Gemmules formation:** It occurs in sponges.

Reading between the lines

Asexual Reproduction

Binary fission: In this, parent cell divides to produce two equal cells that give rise to two new individuals. e.g. Bacteria and Amoeba.

Conidia formation: Fungi produce non-motile spores called conidia. e.g. Penicillium.

Gemmule formation: Gemmules are internal buds found in sponges and are involved in asexual reproduction.

NCERT Corner

i. **Sprorulation:**
When the products of multiple fission become individually surrounded by the cyst walls before their release from the parent, the process is known as sporulation. The spores remain inactive in the cyst during unfavourable conditions. When condition becomes favourable, the cyst hatches and gradually grows into an adult. It occurs in *amoeba*.

ii. **Regeneration:**
Regeneration is the process of renewal, restoration and growth. It is commonly observed in *Hydra*, planarian flatworm and echinoderms. A lizard can discard a part of tail when in danger, and the tail can regenerate later. In humans, liver can regenerate if partially damaged.

Q.5. Identify the type of asexual reproduction given in the figures.

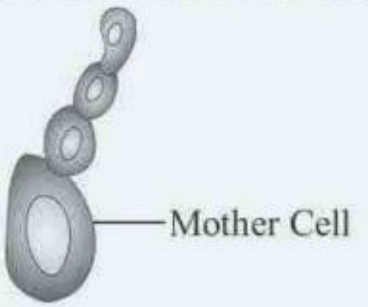


Figure (A)

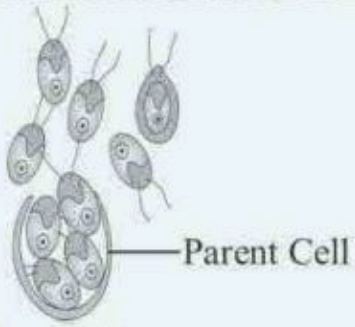


Figure (B)

Ans: Figure (A): Budding in yeast
Figure (B): Zoospores in *Chlamydomonas*

Q.6 Activity. *(Textbook page no. 01)*
Sprinkle a small spoonful of yeast over warm water and then add sugar. Cover it and wait for 10 minutes. Yeast becomes bubbly over the water proving that it is still active.

Ans:

i. In the given activity, yeast solution becomes bubbly after 10 minutes.
ii. It is due to favourable conditions yeast cells undergo asexual reproduction i.e. budding.
iii. During this process, gas like carbon dioxide is formed in the mixture of yeast, sugar and water.
iv. As the number of yeast cells divides, more gas is formed due to which mixture becomes bubbly proving that yeast is still active.

Q.7. Can you recall? *(Textbook page no. 01)*
The capacity to reproduce by vegetative propagation:
Root - Sweet potato, *Asparagus*, *Dahlia*.
Leaf - *Bryophyllum*, *Kalanchoe*, *Begonia*, etc.
Stem - rhizome (turmeric), tubers (potato), bulbs (onion), etc.
How does vegetative propagation occur in nature?

Ans: *Refer Q.1 (i-b)*

Reading between the lines

Vegetative propagation by root: e.g. Sweet Potato

i. It is a modification of root for vegetative reproduction.
ii. The underground roots in some plants store plenty of reserve food. Due to this, they become swollen.

iii. *These roots develop adventitious buds on their surface which sprout under favourable conditions to produce leafy shoots and adventitious roots.*

iv. *Under suitable environmental conditions, these leafy shoots separate and develop into new plants.*

Vegetative propagation by stem:

i. *Rhizome: Small plantlets develop from rhizome of ginger.*

ii. *Tuber: Small plantlets emerge from the eyes (buds) of potato tuber.*

iii. *Bulbs: It is condensed disc like underground stem. The upper surface of disc bears whorl of fleshy leaves. e.g. Onion, garlic.*

Vegetative propagation by leaf:

i. *In some plants like Bryophyllum, leaves take part in vegetative propagation.*

ii. *Adventitious buds called epiphyllous buds are developed on the leaves. These buds start sprouting on the leaf to form the plantlets.*

iii. *These plantlets fall off from parent plant to continue their growth in the wet soil.*

Q.8. Activity. *(Textbook page no. 15)*

Prepare chart for natural vegetative propagation exhibited by flowering plants indicating the vegetative part/s and the different examples.

Ans:

Organ	Part	Name of the plant
Tuber	Stem	Potato
Rhizome	Stem	Ginger
Napiform root	Root	Beet
Stolon	Stem	*Mentha*
Leaf buds	Leaf	*Bryophyllum*
Bulbil	Floral buds	*Agave*
Runner	Stem	Lawn Grass
Bulb	Stem	Onion

*[**Note:** Students are expected to collect more information about natural vegetative propagation exhibited by flowering plants indicating the vegetative part/s and the different examples.]*

Q.9. What are the artificial methods of vegetative propagation?

Ans: Artificial methods of vegetative propagation are as follows:

i. Cutting:

a. The small piece of any vegetative part of a plant having one or more buds is used for propagation.

b. Some of the common cuttings are:
Stem cutting - e.g. Rose, *Bougainvillea*; leaf cutting - e.g. *Sansevieria*; root cutting e.g. Blackberry.

ii. Grafting:

a. In this, parts of two plants are joined in such a way that they grow as one plant.

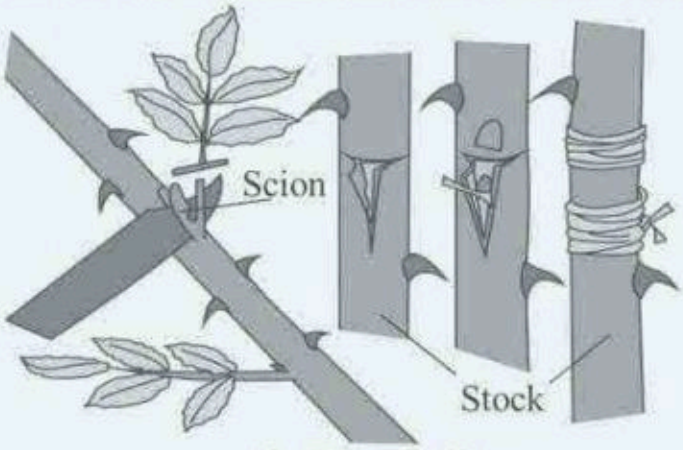
b. Part of the rooted plant on which grafting is done is called **stock** (root stock).

c. While the part which is inserted on stock is called **scion** (graft).

d. Budding is also called **bud grafting** in which single bud is a scion.

e. A single bud is then inserted in the slit of the stock.

f. Grafting is done in plants like Apple, Rose, Pear, etc.



Grafting in Rose

iii. Tissue culture:

It is a method in which small amount of tissue is taken from shoot tips or other suitable part of the parent plant and grown on a culture medium under aseptic conditions to give many plantlets. Micropropagation method is also used now a days.

Connections

In chapter 11, you will study Tissue culture and Micropropagation in detail.

Enrich Your Knowledge

Grafting:

i. This is the characteristic feature of dicotyledonous plants which have cambium for secondary growth.

ii. As monocots do not have inter or intrafascicular cambium and do not show secondary growth, grafting is not possible in monocots.

iii. The success of grafting depends upon the match of cambium between stock and scion which results in organic connection between them.

iv. Common methods of grafting are Tongue (whip) grafting, Wedge grafting and Crown grafting, etc.

Q.10. Do you know? *(Textbook page no. 02)*

Why does gardener choose to propagate plants asexually?

Ans: Gardner chooses to propagate plants asexually because of following advantages:

i. It is more rapid, easier and cheaper method of propagation of plants as compared to propagation by seeds.

ii. It is possible to obtain clones as plants produced will have same characters as that of parent plants.

iii. It is the means of reproduction in those plants where sexual reproduction is absent or do not form viable seeds. e.g. Banana, Figs, Pineapple, etc.

iv. By the methods like grafting desired character of the stock (e.g. disease resistance, vigour, etc.) can be transferred to the scion.

v. The yield can be increased by grafting the high yielding variety on the stock of variety with low yield which is better adapted to particular region.

vi. It is easy to get rid of pathogens from any part of the plant by vegetative propagation.

vii. It helps in the production of clones of economically useful and rare plants.

1.2 Sexual Reproduction

NCERT Corner

i. Before organisms can reproduce sexually, they have to reach a certain stage of growth and maturity, which is called the **juvenile phase** in animals. In plants, it is called **vegetative phase**. This phase has variable durations in different organisms.

ii. The **reproductive phase** begins after the end of juvenile/vegetative phase. Flowering in higher plants marks the beginning of the reproductive phase. Few plants exhibit unusual flowering phenomenon:
For e.g.
   a. Bamboo species flower only once in their lifetime, generally after 50 – 100 years, produce numerous fruits and die.
   b. *Strobilanthus kunthiana* (Neelakuranji) flowers once in 12 years.

Q.11. Define flower and write its function.

Ans:

i. The flower is specialized reproductive structure of a plant in which sexual reproduction takes place.

OR

Flower is defined as "**a highly specialized reproductive shoot**", concerned with sexual reproduction in higher plants.

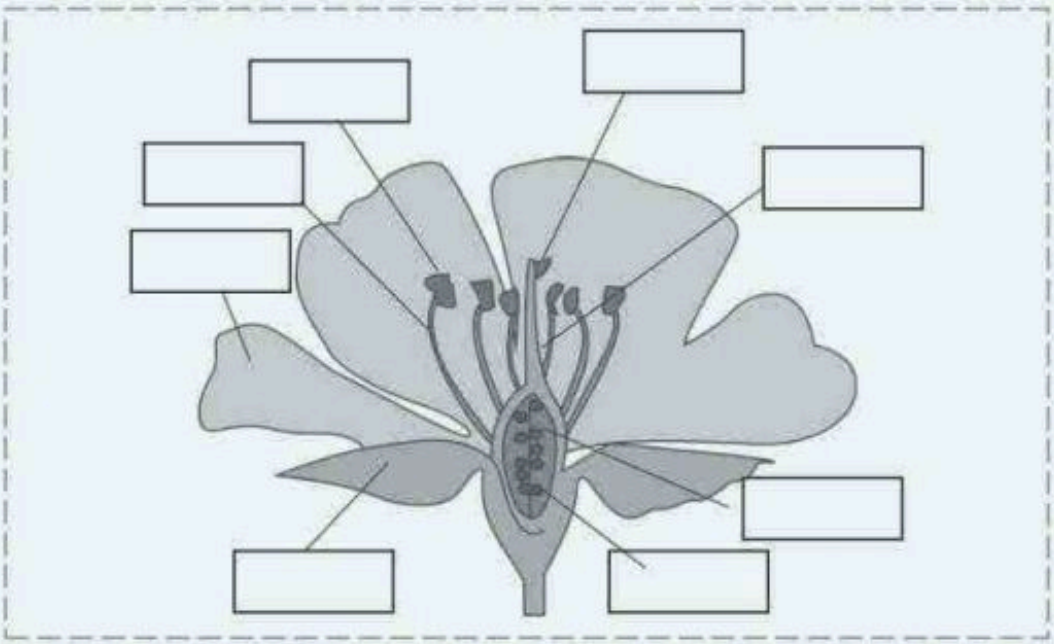
OR

Flower is a condensed and modified shoot, specialized for sexual reproduction.

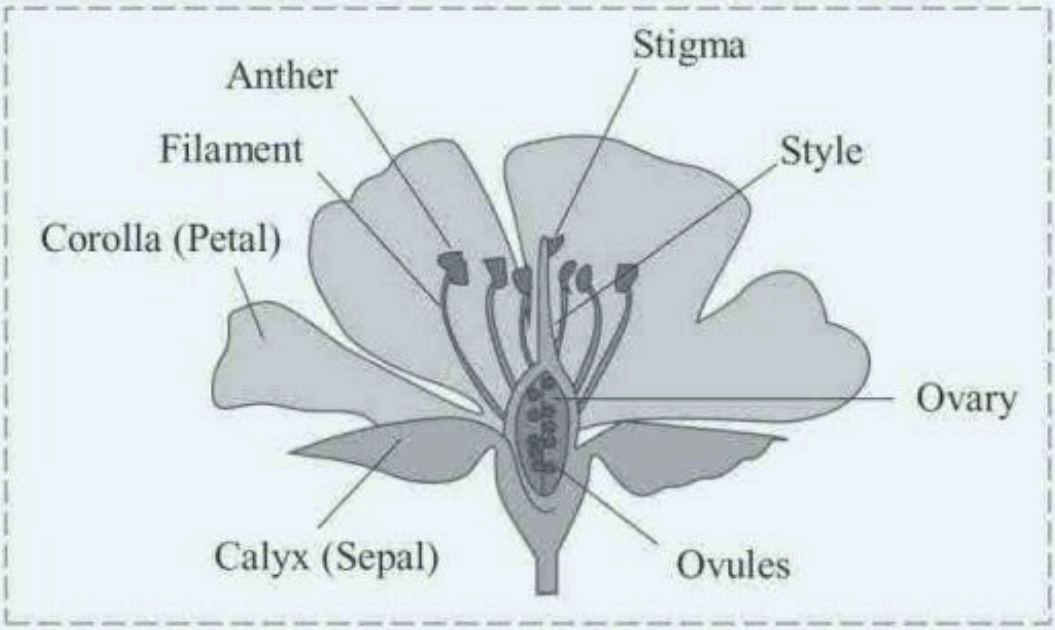
ii. The function of flower is to produce haploid gametes and to ensure that fertilization will take place.

Q.12. Activity *(Textbook page no. 02)*

Label the parts of flower in the given diagram.



Ans:



Q.13. Name the four whorls of a typical flower.

Ans: A typical flower consists of Calyx, Corolla, Androecium and Gynoecium.

Q.14. Write a short note on sexual reproduction.

Ans: Sexual reproduction:

i. It is a mode of reproduction which involves fusion of two compatible gametes or sex cells.

ii. Sexual reproduction involves two major events viz. meiosis (gamete formation) and fusion of gametes.

iii. Fusion of male and female gametes (fertilization) results in zygote formation and embryogenesis (embryo formation).
iv. Fusion of gametes leads to production of genetically dissimilar offsprings.
v. Variations are useful from the point of view of the survival and the evolution of species, over the time.
vi. Sequential events that occur in sexual reproduction are grouped into three distinct stages viz. Pre-fertilization, Fertilization and the Post-fertilization.

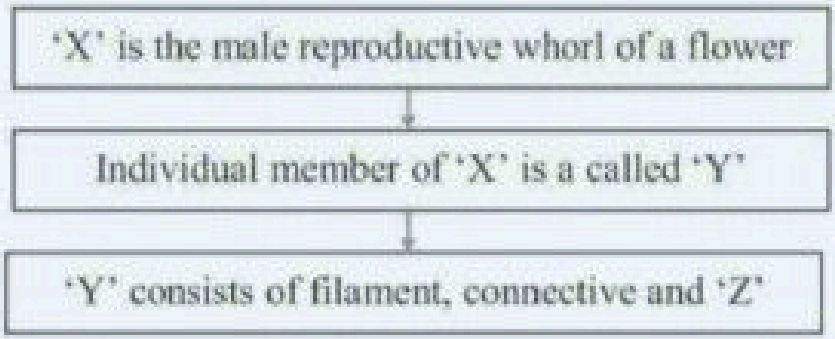
Q.15. Complete the given flow chart.

Ans: A: Diploid Sporophyte B: Gametophyte

Enrich Your Knowledge

Diploid sporophyte is the predominant plant body in all angiosperms, where meiosis takes place to produce haploid spores that form gametophyte. Gametophytes are considerably reduced and develop within the flower. They produce gametes.

Q.16. Identify X, Y and Z in the given chart.



Ans: X: Androecium
Y: Stamens
Z: Anther

Q.17. Explain in detail the structure of an anther.

Ans: Structure of an anther:

i. Anther is upper sac-like fertile part of the stamen.

ii. An immature stage of anther is represented by group of parenchymatous tissue surrounded by single layered epidermis.

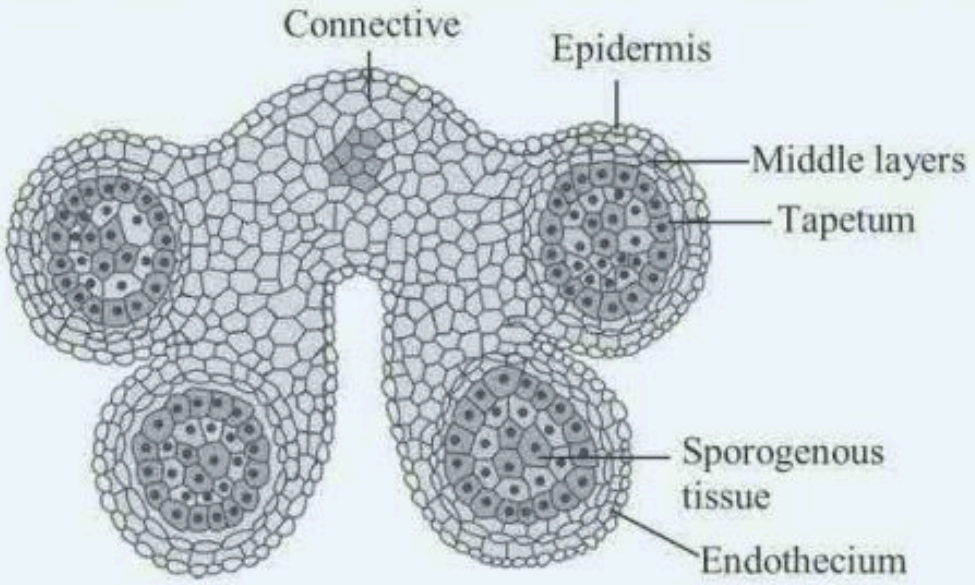
iii. Anther consists of two anther lobes (dithecous), sometimes anther consists of one lobe (monothecous).

iv. In dithecous anther four pollen sacs are present, hence called as tetrasporongiate.

v. Each monothecous anther contains of two pollen sacs.

Q.18. With the help of neat and labelled diagram explain the T.S. of anther.

Ans:



T. S. of Anther

i. Sporogenous tissue:

Some hypodermal cells get transformed into archesporial cells.

The archesporial cell divides into an inner sporogenous cell and outer primary parietal cell.

Sporogenous cell forms sporogenous tissue.

Each cell of sporogenous tissue is capable of giving rise to a microspore tetrad.

ii. Anther wall:

Parietal cell undergoes divisions to form anther wall layers. The anther wall is divided into four layers as follows:

a. Epidermis: It is the outermost protective layer made up of tabular (flattened) cells.

b. Endothecium: It is sub-epidermal layer made up of radially elongated cells with fibrous thickenings.

c. Middle layers: Inner to endothecium is middle layer made up of thin walled cells (1-2 layered), which may disintegrate in mature anther.

d. Tapetum: It is the inner most nutritive layer of anther wall. It immediately encloses the sporogenous tissue (microspore mother cells).

***Q.19. Name the layer which supplies nourishment to the developing pollen grains.**

Ans: Tapetum supplies nourishment to the developing pollen grains.

1.3 Microsporogenesis

Q.20. Define microsporogenesis.

Ans: It is a process in which each microspore mother cell divides meiotically to form tetrad of haploid microspores (pollen grains).

OR

The process of formation of microspores from diploid microspore mother cell through meiotic cell division inside the microsporangia or pollen sacs is called microsporogenesis.

Q.21. Explain in detail the structure of microspore.

Ans: **Structure of microspore:**

i. Pollen grain/microspore is a non-motile, haploid, unicellular body with single nucleus.

ii. It is surrounded by a two layered wall called **sporoderm**.

iii. The outer wall is called **exine** and the inner wall is called **intine**.

iv. **Exine:**

a. The exine is thick and made up of complex, non-biodegradable, substance called **sporopollenin**.

b. It may be smooth or with a sculptured pattern (characteristic of the species).

c. It is resistant to chemicals.

d. At some places exine is very thin showing thin areas known as **germ-pores**.

e. Germ-pores are meant for the growth of emerging pollen tube during germination of pollen grain.

v. **Intine:**

The inner wall layer, intine consists of cellulose and pectin.

Q.22. Find Out *(Textbook page no. 03)*

Why pollen grains can remain well preserved in fossil?

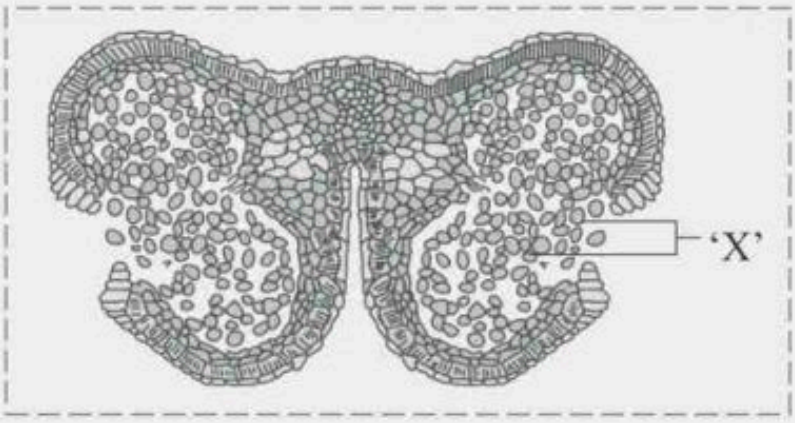
Ans:

i. Exine of pollen grain is made up of a complex, non-biodegradable, substance called sporopollenin.

ii. Sporopollenin provides resistance to a pollen grain from high temperatures, strong acids and alkalis.

Thus, pollen grains can remain well preserved in fossil.

Q.23. Identify 'X' in the given figure and write a short note on its structure.



Ans:

i. In the given figure 'X' represents **pollen grains.**

ii. For structure of pollen grain: *Refer Q.21.*

NCERT Corner

Harmful effects of Pollen grains:

i. Pollen grains of many species cause severe allergies and bronchial afflictions leading to chronic respiratory disorders like asthma and bronchitis.

ii. *Parthenium* (Carrot grass) causes pollen allergy.

Uses /Benefits of Pollen grains:

i. Rich in nutrients.

ii. Pollen tablets are used as food supplements.

iii. A large number of pollen products in the form of syrups and tablets are available in the market in western countries.

iv. Pollen consumption enhances the performance of athletes and race horses.

Q.24. Write a short note on pollen viability.

Ans: **Pollen viability:**

i. Pollen viability is the functional ability of pollen grain to germinate to develop male gametophyte.

ii. It depends upon environmental conditions of temperature and humidity.

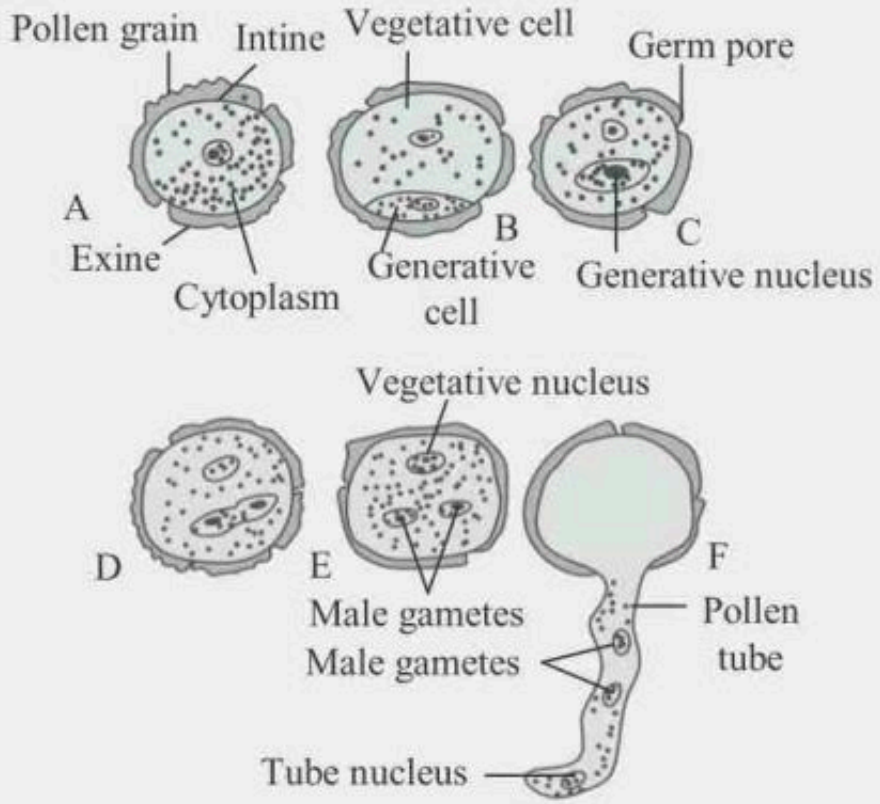
iii. In rice and wheat, pollen grains remain viable for 30 minutes of their release, whereas in some members of Rosaceae, Leguminoseae, Solanaceae, they remain viable for months.

NCERT Corner

Pollen grains of a large number of species can be stored in liquid nitrogen (–196 °C) for many years.
These stored pollen can be used as pollen banks.

***Q.25. Explain the stages involved in the maturation of microspore into male gametophyte.**

Ans: Maturation of microspore into male gametophyte:



Development of male gametophyte

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

ii. It undergoes first mitotic division to produce bigger, naked vegetative cell and small, thin walled generative cell.

iii. The vegetative cell is rich in food and having irregular shaped nucleus.

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

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

vi. The mitotic division of generative cell takes place either in pollen grain or in the pollen tube.

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

Reading between the lines

Development of male gametophyte

Before pollination in the pollen sac:

Refer Q.25 (i-vii)

viii. In some angiosperms, the generative cell divides by mitosis to form two male gametes and therefore, three-celled pollen grains are released from anther.

After pollination on the stigma:

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

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

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

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

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

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

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

Q.26. Arrange the following terms in a correct developmental sequence: Pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell, male gametes. [NCERT]

Ans: Sporogenous tissue, pollen mother cell, microspore tetrad, pollen grain, male gametes.

1.4 Structure of Anatropus Ovule

Q.27. Name the following and give example wherever possible.

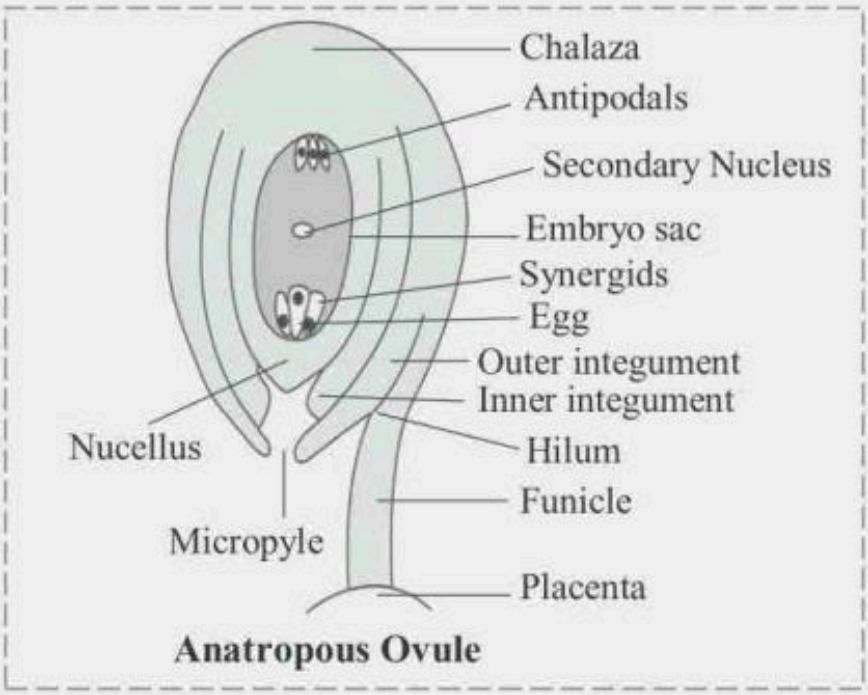
i. Female reproductive whorl of flower.
ii. Individual member of gynoecium is called as.
iii. Flower in which gynoecium possesses many free carpels is called as
iv. Flower in which gynoecium possesses many fused carpels is called as
v. Ovary with single ovule.
vi. Ovary with many ovules.

Ans:

i. Female reproductive whorl of flower: **Gynoecium (Pistil)**
ii. Individual member of gynoecium is called as: **Carpel (megasporophyll)**
iii. Flower in which gynoecium possesses many free carpels is called as: **Apocarpous (e.g. *Michelia*)**
iv. Flower in which gynoecium possesses many fused carpels is called as: **Syncarpous (e.g. *Brinjal*)**
v. Ovary with single ovule: **Uniovulate (e.g. paddy, wheat and mango)**
vi. Ovary with many ovules: **Multiovulate (e.g. tomato and lady's finger)**

Q.28. Draw neat and labelled diagram of anatropous ovule and explain its structure in detail.

Ans: Structure of anatropous ovule:



Anatropous Ovule

i. Anatropous ovule is the most common type of ovule in angiosperms. It consists of following parts:

ii. **Funiculus / Stalk / Funicle:**
Each ovule develops inside the ovary. Ovule is attached to the placenta by a small stalk called funiculus.

iii. **Hilum:**
The point of attachment of funiculus to the main body of ovule is known as hilum.

iv. **Nucellus:**
The ovule consists of central parenchymatous tissue called nucellus.

v. **Integuments:**
Nucellus is usually surrounded by two protective coverings called integuments viz. outer and inner integument.

vi. **Micropyle:**
A narrow opening at the apex of the ovule is called micropyle. It anatropous ovule, micropyle is directed downwards and is present adjacent to the funiculus (funicle).

vii. **Chalaza:**
Chalaza is the base of ovule directly opposite to micropyle.

viii. **Embryo sac:**
Embryo sac (female gametophyte) is oval multicellular structure embedded in the nucellus.

Reading between the lines

Embryo sac:
It is 8-nucleated and 7-celled structure. It consists of:

i. Egg apparatus: It is a group of 3 cells towards micropylar end. The central cell is the female gamete, i.e. egg (oosphere) flanked by two cells which are called synergids.

ii. Secondary nucleus: It is a diploid structure formed by fusion of 2 polar nuclei.

iii. Antipodal cells: It is group of three cells towards chalazal end.

1.5 Megasporogenesis

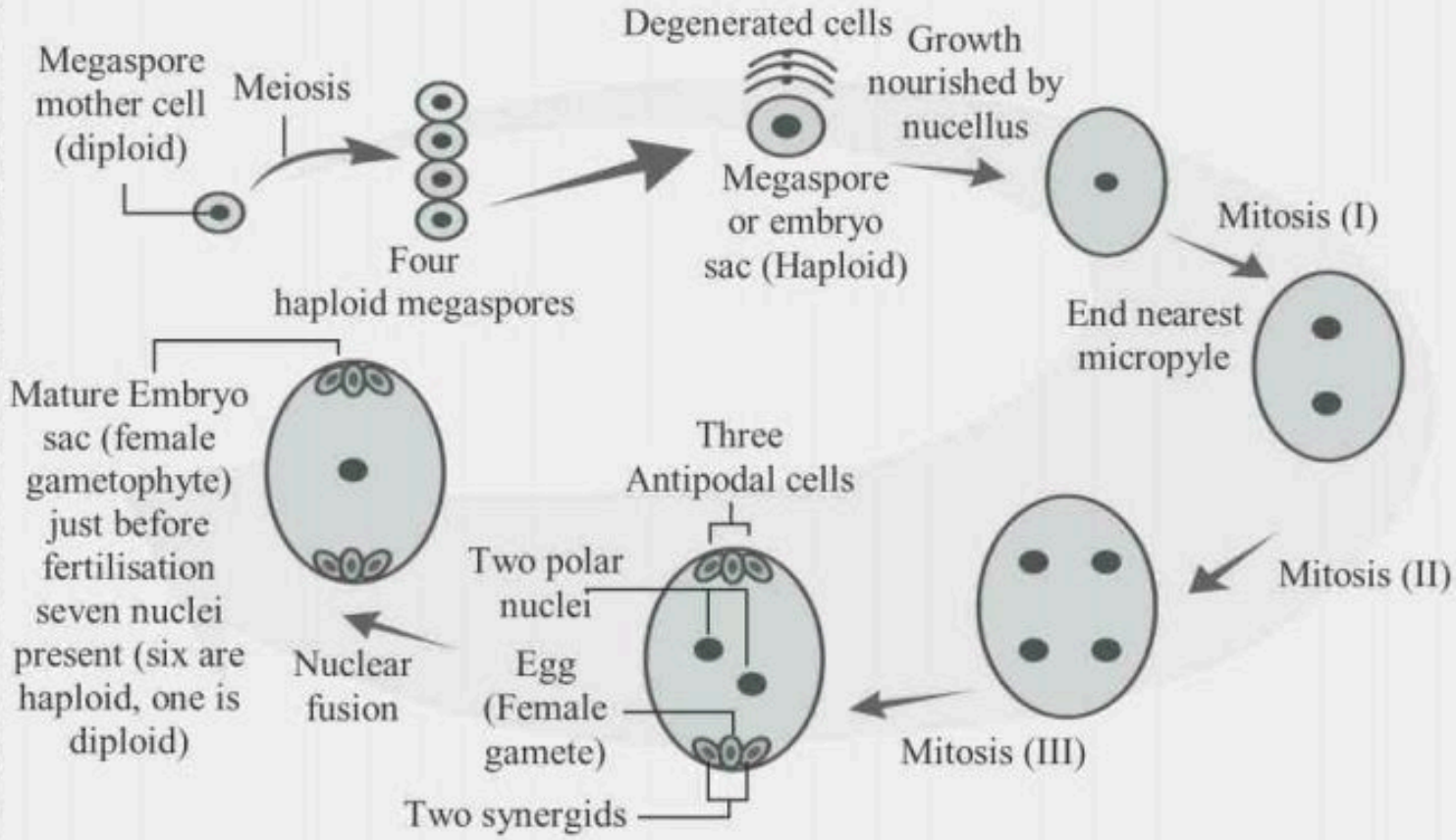
***Q.29. Define megasporogenesis.**

Ans: **Megasporogenesis:**

It is the process of formation of haploid megaspores from diploid megaspore mother cell (MMC) by meiotic division.

Q.30. With the help of neat and labelled diagram explain the development of female gametophyte.

Ans:



Development of female gametophyte

i. The diploid **Megaspore mother cell** undergoes meiosis to form linear tetrad of haploid cells i.e. **megaspore.**

ii. Upper three megaspores degenerate and lowest one towards centre of nucellus remains functional. It acts as the first cell of female gametophyte.

iii. **The functional megaspore** undergoes three successive, free nuclear mitotic divisions.

iv. Thus total eight nuclei are formed, four of which are located at each pole.

v. One nucleus from each pole migrates towards the centre and are called **polar nuclei**.
vi. Three nuclei towards micropylar end constitute **egg apparatus**.
vii. Egg apparatus consists of large central, haploid **egg cell** and two supporting haploid **synergid cells**.
viii. Synergid shows hair like projections called **filiform apparatus**, which guide the pollen tube towards the egg.
ix. **Antipodal cells** are group of three cells present at the chalazal end.
x. The two haploid polar nuclei of large central cell fuse to form **diploid secondary nucleus** or definitive nucleus, just prior to fertilization.
xi. This seven celled and eight nucleated structure is called an **embryo sac**.
xii. Since embryo sac develops from a single megaspore, it is described as **monosporic development**.
xiii. In angiosperms, the development of female gametophyte is **endosporous** i.e. within the megaspore.
xiv. Female gametophyte is colourless, endosporic and is concealed in the ovule enclosed by ovary.

***Q.31. How many haploid cells are present in a mature embryo sac?**
Ans: Total 6 haploid cells are present in a mature embryo sac. They are antipodal cells (3), synergids (2) and egg cell (1).

***Q.32. What is the function of filiform apparatus?**
Ans: Filiform apparatus guide the entry of pollen tube towards the egg.

Q.33. i. Differentiate between Microsporogenesis and Megasporogenesis.
ii. Which type of cell division occurs during these events?
iii. Name the structures formed at the end of these two events.
[NCERT]

Ans:
i. **Difference between Microsporogenesis and Megasporogenesis.**

No.	Microsporogenesis	Megasporogenesis
a.	It is the formation of microspores from microspore mother cells due to meiosis.	It is the formation of megaspores from a megaspore mother cell due to meiosis.
b.	Microspore leads to the development of male gametophyte.	Megaspore leads to the formation of female gametophyte (embryo sac).
c.	Occurs in pollen sacs (microsporangia) in anther lobes.	Occurs in nucellus of ovule.

ii. Type of cell division during microsporogenesis and megasporogenesis: **Meiosis.**

iii. **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 the development of female gametophyte (embryo sac).

1.6 Pollination

Q.34. Define pollination. Enlist agents for pollination and write how they are important to angiosperms.

Ans:

i. **Pollination:** The transfer of pollen grains from anther to the stigma of the flower is called as pollination.

ii. **Agents of pollination:**
   a. Biotic agents: Birds, insects, snail, etc.
   b. Abiotic agents: Wind, water

iii. Angiosperms use biotic and abiotic agents feeding the visitors (biotic agents) and exploiting their mobility for pollination and also for seed dispersal. Most of the food and fibre crops grown throughout the world depend upon pollinators for reproduction.

Q.35. What are the two main types of pollination?

Ans: **Two main types of pollination are:**

i. **Self-pollination:**
Self-pollination is a type of pollination which occurs in a single flower or two flowers on a single plant.

OR

It is the transfer of pollen grains from anther to the stigma of same flower or a different flower produced on the same plant.
It results in inbreeding or selfing.

ii. **Cross pollination:**
It is the transfer of pollen grains from the anther of one flower to the stigma of another flower of different plants of same species.

OR

It is the transfer of pollen grains from anther of a flower to the stigma of another flower produced on a different plant having dissimilar genetic make-up, with the help of external agents like wind, water, insects, etc.

Q.36. Define the following terms:

i. Chasmogamy ii. Cleistogamy
iii. Homogamy

Ans:

i. **Chasmogamy:** When flower opens to expose its sex organ, the condition is called as chasmogamy.

ii. **Cleistogamy:** Some flowers are self-pollinated even before the opening of flower such condition is called as cleistogamy.
*[**Note:** Cleistogamous flowers are always closed because of which self-pollination is the only method of pollination in these flowers.]*

iii. **Homogamy:** When anther and stigma of a flower become mature at the same time, it is called homogamy.

Q.37. Name the plants which exhibits both chasmogamous and cleistogamous flowers on the same plant.

Ans: *Viola*, *Commelina benghalensis*.

Q.38. Think about it *(Textbook page no. 06)*
Why do some plants have both chasmogamous and cleistogamous flowers?

Ans:

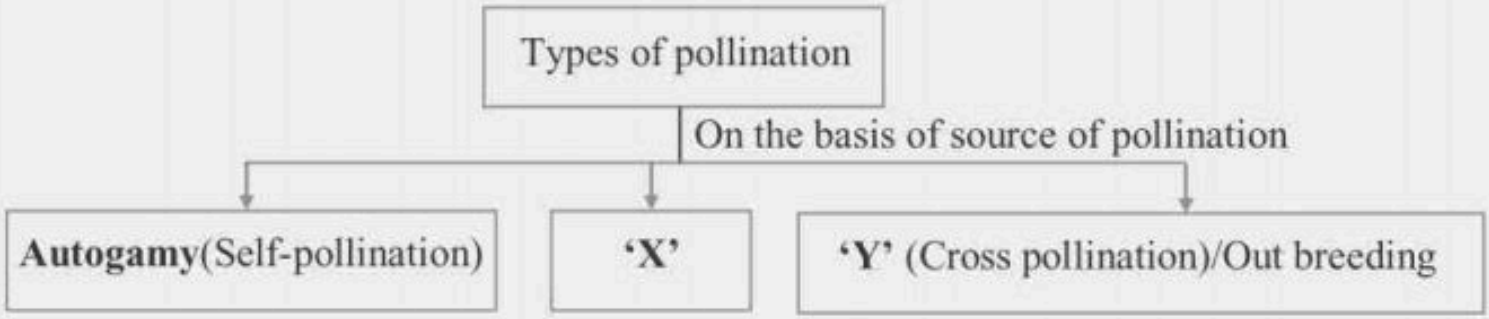
i. Plants like *Viola*, *Commelina* produce both chasmogamous and cleistogamous flowers.

ii. Chasmogamous flowers expose their anther and stigma. In such flowers, anther and stigma lie close to each other to effect pollination.

iii. Cleistogamous flowers do not open, thus there is no chance of cross-pollen landing on the stigma.

iv. Thus to ensure pollination and seed formation, some plants have both chasmogamous and cleistogamous flowers.

Q.39. Complete the given flow chart.



Ans: X: Geitonogamy
Y: Xenogamy

Q.40. What is autogamy?

Ans: It is a type of pollination in which bisexual flower is pollinated by its own pollen grains.
Offsprings are genetically identical to their parents e.g. pea.

Q.41. Give reason: Geitonogamy is similar to autogamy but functionally it is cross pollination.

Ans:

i. Geitonogamy is a transfer of pollen grain to a stigma of a different flower produced on the same plant.

ii. Thus it is similar to autogamy as pollen grains come from same plant.

iii. However it requires pollinating agent.

iv. Also it cannot bring about genetic variations and is only of ecological significance.

Thus, geitonogamy is similar to autogamy but functionally it is cross pollination.

Q.42. What is Xenogamy?

Ans: **Xenogamy/ cross pollination/ out breeding:**

i. It is a type of cross pollination when pollen grain of one flower is deposited on the stigma of a flower of different plant belonging to same species, with the help of pollinating agency.

ii. It generates genetically varied offsprings.

Q.43. Define anemophily and enlist the adaptations in anemophilous flowers.

Ans:

i. **Anemophily:** Pollination carried out by wind is called as anemophily. Important crop plants like wheat, rice, corn, rye, barley, oats and other plants like palms are wind pollinated.

ii. **Adaptations in anemophilous flowers:**

a. The flowers are small, inconspicuous, colourless, without nectar and fragrance (odour).

b. The pollen grains are light in weight, dry and produced in large numbers to increase chances of pollination considering wastage of pollen grains.

c. Stigma is feathery to trap pollens carried by wind currents.

d. Stamens are exserted with long filaments and versatile anthers.

e. Stamens and stigmas are exposed to air currents.

Enrich Your Knowledge

i. Anemophily is considered as the most primitive type of pollination.
ii. The pollens of wind pollinated plants are most frequently associated with symptoms of hayfever among people those are sensitive to pollens. It is caused by hypersensitivity to pollen.

***Q.44. What is hydrophily?**

Ans: Pollination carried out by water is called hydrophily.

Q.45. Enlist the adaptations in hydrophilous flowers. Give examples of hydrophilous flowers.

Ans:

i. Adaptations in hydrophilous flowers:
   a. Flowers are small and inconspicuous.
   b. Perianth and other floral parts are unwettable.
   c. Pollen grains are long and unwettable due to presence of mucilage.
   d. Nectar and fragrance are lacking in flowers.
ii. It is found in some 30 genera of aquatic monocots. E.g. *Vallisneria*, *Zostera*, *Ceratophyllum* etc.

Q.46. Explain two types of hydrophily in detail.

Ans: Two types of hypohydrophily:

i. Hypohydrophily:
   a. In this pollination occurs below the surface of water.
   b. Here the pollen grains are heavier than water, thus they sink down and caught by stigmas of female flowers.
   c. For e.g. In *Zostera* (sea grass) the pollen grains are long, ribbon like and without exine.
ii. Epihydrophily:
   a. In this pollination occurs on the surface of water.
   b. The pollen grains float on the water surface and reach the stigma of female flower.
   c. *Vallisneria* is a submerged dioecious, fresh water aquatic plant. In this, female flowers reach the water surface temporarily to ensure pollination and male flowers float on the surface of water.

d. Specific gravity of these pollen grains is equal to that of water. Due to which they float on surface of water.

e. Due to water currents, pollen grains are carried to stigma and pollination occurs.

Q.47. Identify the types of pollination in the given plants.

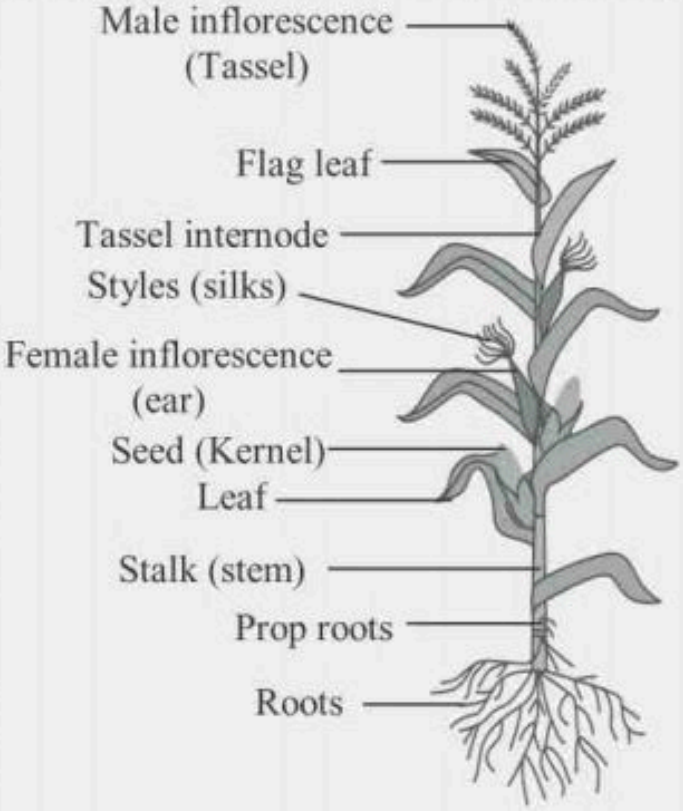


Figure 'A'

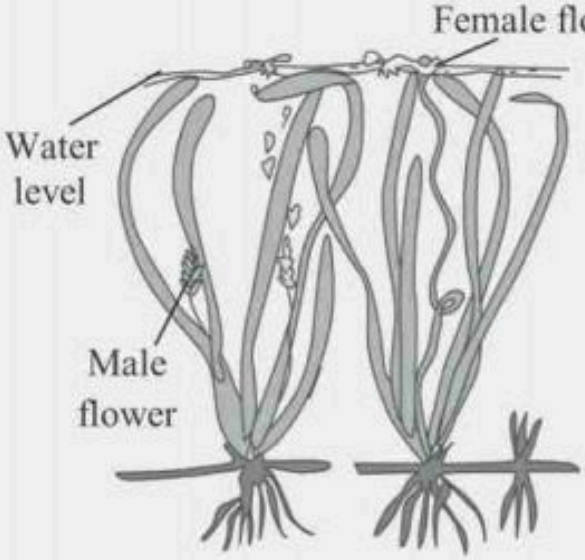


Figure 'B'

Ans:

i. Figure A represents maize plant which shows anemophilous flowers. Thus it shows wind pollination (Anemophily).

ii. Figure B represents male and female plant of *Vallisneria*. It shows epihydrophily type of water pollination (Hydrophily).

Q.48. Name the following:

i. Aquatic plants which are anemophilous

ii. Aquatic plants which are entomophilous

Ans:

i. Aquatic plants which are anemophilous: *Potamogeton*, *Halogaris*, etc.

ii. Aquatic plants which are entomophilous: Lotus, water hyacinth, water lily, etc.

*[**Note**: Some species of Potamogeton are entomophilous, anemophilous or hydrophilous].*

Q.49. Write a short note on entomophily.

Ans: **Entomophily:**

i. Pollination carried out by insects is called as entomophily.

ii. Entomophilous flowers show following adaptations:
   a. They are large, showy and often brightly coloured.
   b. The flowers produce sweet odour (smell) and have nectar glands.
   c. The stigma is rough due to presence of hair or is sticky due to mucilaginous secretion.
   d. The pollen grains are spiny and surrounded by a yellow sticky substance called pollenkitt.

iii. Entomophily is commonly occurs in Rose, Jasmine, *Cestrum*, *Salvia*, etc.

Enrich Your Knowledge

Pollenkitt is a sticky,oily covering present on the surface of a pollen grain.
It contains lipids, carotenoids.
Pollenkitt is secreted by tapetum.
It is present on the pollen grains of those flowers which are fertilized by insects (entomophily) so that the pollen grain sticks to the insects.

Q.50. Explain the term pollination syndromes.

Ans:

i. Plants in which pollination occurs through biotic agents are adapted to encourage the specific pollinators they need.

ii. Such plants develop pollination contrivance.

iii. Plants and pollinators have co-evolved physical characteristics that make them to interact successfully. Such characteristics are considered pollination syndromes.

Q.51. Describe the given picture with respect to pollination.

Ans:

i. The given picture shows **lever mechanism** or turn-pipe mechanism in *Salvia*.

ii. *Salvia* is an entomophilous plant, thus pollination occurs through insects.

iii. *Salvia* plants have special adaptations for the insect visitor to help in cross pollination.

Enrich Your Knowledge

Lever mechanism or turn-pipe mechanism in *Salvia:*

i. In *Salvia*, flower is bisexual and protandrous, i.e. anthers mature earlier than stigma.

ii. The two stamens of flower have long bifurcated connective.

iii. Upper branch of connective shows fertile anther lobe, while lower has sterile anther lobe.

iv. When an insect enters the flower, it pushes the lower sterile lobes. Due to which the upper fertile anther lobe bends down.

v. The fertile anther lobe comes in contact with back side of insect body and pollen grains are dusted there.

vi. When the same insect visits another flower with matured gynoecium, the pollen grains are picked up by the receptive stigma.

NCERT Corner

Biotic agencies of pollination:

i. *Amorphophallus* →Tallest flower (6 feet in height) → provides floral rewards as safe place to lay eggs for insects.

ii. Species of moth and *Yucca* plant → Both cannot complete their life cycles without each other. Moth deposits eggs in locule of ovary, flower gets pollinated by moth. Larvae of moth come out of the eggs as the seeds develop.

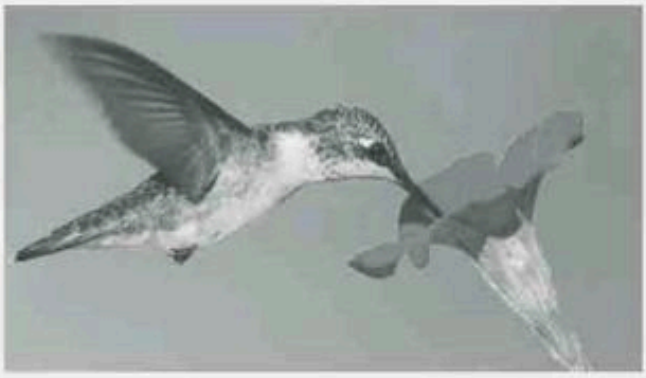
iii. Pollen/nectar robbers → These are floral visitors (insect) which consume pollen or nectar without bringing about pollination.

GG - Gyan Guru

Bumblebee

Some species of bumblebee nest underground in holes made by rodents, while some above the ground, in thick grass,etc.
When searching for a nest, the queen investigates the suitable site using both sight and smell. When she finds such site, she investigates by going into the hole.
Bumblebee nest lasts only for a season
Inside a bumblebee nest queen lays eggs. There are many worker bees, who help to look after the nest, collect food, and raise new offspring.
We need to help bees as they do a wonderful job of pollinating plants, wildflowers and economically important crops and vegetables.

Q.52. Write a short note on the type of pollination shown in the given picture.



Ans:

i. The given picture represents pollination by birds **(Ornithophily)**.
ii. Small birds like Sun birds, humming birds perform ornithophily.
iii. Some ornithophilous plants are *Bombax*, *Callistemon* (Bottle Brush), *Butea*, etc.
iv. Ornithophilous plants shows following adaptations:
   a. Flowers are usually brightly coloured, large and showy.
   b. They secrete profuse, dilute nectar.
   c. Pollen grains are sticky and spiny.
   d. Flowers are generally without fragrance, as birds have poor sense of smell.

Q.53. Define Chiropterophily and enlist the adaptations in chiropterophilous flowers.

Ans:

i. **Chiropterophily:** Pollination carried out by bats is called chiropterophily. Bats can transport pollens over long distance, sometimes several kilometers.

ii. **Adaptations in chiropterophilous flowers:**

a. Flowers are dull coloured with strong fragrance.

b. They secrete abundant nectar.

c. Flowers produce large amount of edible pollen grains.

d. Chiropterophily is shown by plants like *Anthocephalus* (kadamb tree), *Adansonia* (Baobab tree), *Kigelia* (Sausage tree).

1.7 Outbreeding Devices (Contrivances)

***Q.54. Describe three devices by which cross pollination is encouraged in angiosperms by avoiding self- pollination.**

Ans: Genetic diversity is an essential factor for evolution by natural selection. Continued self-pollination results in the inbreeding depression. Thus, plants have developed many devices to encourage cross pollination. The examples of outbreeding devices are as follows:

i. **Unisexuality:**

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

As flowers are unisexual, self-pollination is not possible.

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

ii. **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:** In this type, anthers mature first, but the stigma of the same flower is not receptive at that time. e.g. in the disc florets of sunflower.

b. **Protogyny:** In this type, stigma of carpel matures earlier than anthers of the same flower. e.g. *Gloriosa*.

iii. **Prepotency:**

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

iv. **Heterostyly (heteromorphy):**

Plants like *Primula* (Primrose) produce two or three types of flowers in which stigmas and anthers are placed at different levels (heterostyly and heteroanthy).

This prevents the pollens from reaching the stigma and pollinating it.

In heteromorphic flowers, pollen grains produced from anther pollinate stigmas produced at the same level.

Thus self-pollination is not possible in such cases.

v. **Herkogamy:**

It is a mechanical device to prevent self-pollination in a bisexual flower. In plants, natural physical barrier is present between two sex organs and avoid contact of pollen with stigma of same flower, in e.g. *Calotropis*, pentangular stigma is positioned above the level of anthers (pollinia).

vi. **Self-incompatibility (self-sterility):**

This is a genetic mechanism due to which the germination of pollen on stigma of the same flower is inhibited, e.g. Tobacco, *Thea*

[Any three devices]

Enrich Your Knowledge

In all breeding programmes, the plants are hand pollinated to ensure cross pollination between selected varieties. e.g. wheat, rice.

1.8 Pollen-Pistil Interaction

Q.55. Explain in detail Pollen-Pistil interaction.

Ans: **Pollen-Pistil interaction:**

i. All the events from the deposition of pollen grain on stigma to the entry of pollen tube in the ovule (through synergid) are referred as pollen-pistil interaction.
ii. It is the interaction of pollen grains with sporophytic tissue (stigma).
iii. It begins with pollination and ends with fertilization.
iv. Pollination does not guarantee the transfer of right type of pollen, sometimes wrong type of pollen may also land on stigma.
v. The pistil has the ability to recognise and accept the right or compatible pollen of the same species. Thus wrong type of pollen is discarded by pistil.
vi. Compatibility and incompatibility of the pollen-pistil is determined by special proteins.
vii. The stigmatic surface of flower refuses other wrong type or incompatible pollen grains. It ensures that only intraspecific pollen germinate successfully.
viii. The compatible pollen absorbs water and nutrients from the surface of stigma, germinates and produces pollen tube. Its growth through the style is determined by specific chemicals.
ix. The stigmatic surface provides the essential prerequisites for a successful germination, which are absent in the pollen.
x. Pollen tube, after reaching the ovary, is pushed through the ovule and reaches the embryo sac.
xi. The tip of the pollen tube enters in one of the synergids and then ruptures to release the contents.
xii. Due to pollen pistil interaction, intense competition develops even in the compatible pollen grains (gametes).

***Q.56. Name the part of gynoecium that determines the compatible nature of pollen grain.**

Ans: **Pistil** determines the compatible nature of pollen grain.

Q.57. Incompatibility is a natural barrier in the fusion of gametes. How will you explain this statement?

Ans:

i. Incompatibility refers to inability of certain gametes even from genetically similar plants species to fuse with each other.

ii. It is considered as the most prevalent and effective device to avoid inbreeding and outbreeding.
iii. Pollen pistil interaction is dynamic process which involves pollen recognition followed by promotion or inhibition of the pollen.
iv. Chemical substances released by the style act as barrier.
v. Typically the pollen belonging to the correct mating type germinates on stigma, develop pollen tube and bring about fertilization.
vi. The pollens belonging to the other mating type are discarded.

Thus, incompatibility is a natural barrier in the fusion of gametes.

Q.58. How pollen grains can be induced to germinate artificially?

Ans:

i. Pollen grain can also be induced to germinate in a synthetic medium.
ii. Sucrose induces pollen germination and tube growth *in vitro*.
iii. Boric acid also facilitates and accelerates pollen germination.

Q.59. What is artificial hybridization?

Ans:

i. Artificial hybridization is the process in which only desired pollen grains are used for pollination and fertilization.
ii. It is one of the major approaches used in the crop improvement.
iii. This is accomplished through emasculation and bagging procedure.

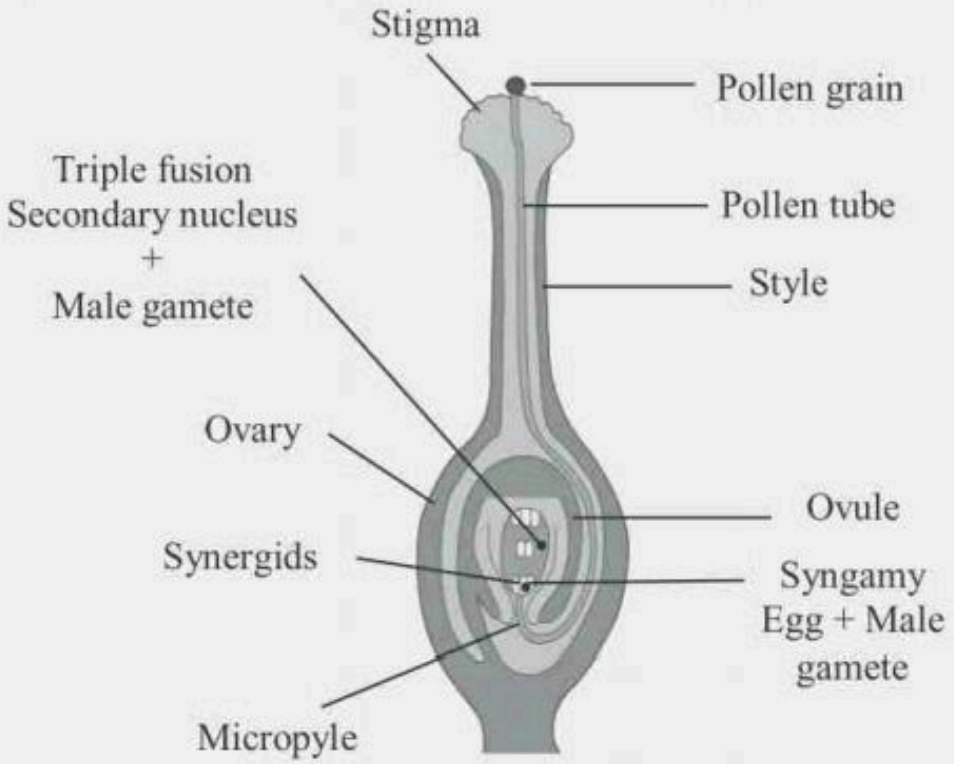
Connections

In chapter 11, you will study artificial hybridization in detail.

1.9 Double Fertilization

***Q.60. Describe the process of double fertilization.**

Ans: Double fertilization:



Double Fertilization

i. The fusion of one male gamete with egg and that of another male gamete with secondary nucleus is called as double fertilization.
It is the characteristic feature of angiosperms.
It was discovered by Nawaschin in the liliaceous plants like *Lilium* and *Fritillaria*.

ii. When pollen grain reaches the surface of the stigma, it germinates and forms a pollen tube.

iii. Pollen tube penetrates the stigma, style, ovary chamber and then enters ovule.

iv. The growth of pollen tube is guided by the chemicals secreted by the synergids.

v. Usually when pollen tube enters ovule through the micropyle, it is termed as **porogamy**.
But in some cases, it enters through chalaza which is known as **chalazogamy**. In some plants it enters by piercing the integuments which is called **mesogamy**.

vi. A pollen tube penetrates embryo sac of ovule through its micropylar end.

vii. The pollen tube carrying male gametes penetrates in one of the synergids.

viii. Watery contents of synergid are absorbed by pollen tube, due to which it ruptures and release the contents, including the two non-motile male gametes.

ix. As non-motile male gametes are carried through hollow pollen tube, it is known as **siphonogamy** that ensures fertilization to take place.

x. Fertilization mainly involves two processes: **Syngamy and Triple fusion.**

a. **Syngamy:**
It is the fusion of haploid male gamete with haploid female gamete (egg). It results in the formation of **diploid zygote** which develops to form **embryo**. Syngamy is a type of generative fertilization.

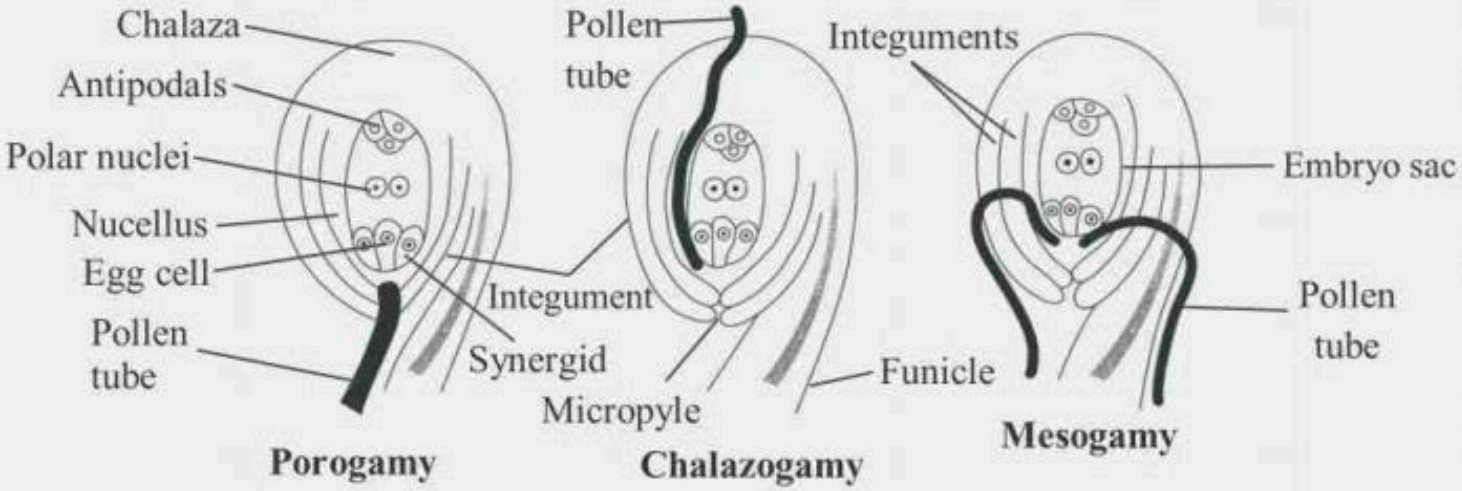
b. **Triple fusion:**
It is the fusion of second haploid male gamete with diploid secondary nucleus. It results in the formation of **Primary Endosperm Nucleus** (PEN) which develops into **triploid endosperm**. Triple fusion is a type of vegetative fertilization.

xi. In this process, both the male gametes participate, due to which fertilization occurs twice in the same embryo sac, hence it is described as **double fertilization.**

*[**Note:** Students can click on the adjacent QR code to get information about **Double fertilization.**]*

Q.61. Draw neat and labelled diagrams of the types of entry of pollen tube into the ovule.

Ans:



Entry of pollen tube into the ovule

Q.62. Write significance of double fertilization.

Ans: **Significance of double fertilization:**

i. It is a unique feature of angiosperms.

ii. It ensures that the parent plant invests a seed with a food store, only if the egg is fertilized.

iii. The diploid zygote develops into an embryo which consequently develops into a new plant.

iv. The triploid PEN develops into nutritive endosperm tissue.

v. It restores the diploid condition by fusion of haploid male gamete with haploid female gamete (i.e. through syngamy).

vi. It also helps to avoid polyembryony.

Reading between the lines

Other significance of double fertilization:

i. Both male gametes are utilized.

ii. As male and female gametes fuse, there is recombination of maternal and paternal characters, which results in variation.

iii. Seeds are viable with high percentage of germination.

***Q.63. Even though each pollen grain has 2 male gametes, why atleast 20 pollen grains are required to fertilize 20 ovules in a particular carpel?**

Ans: During double fertilization, one of the male gamete of pollen grain fuses with egg cell, while other male gamete fuses with secondary nucleus. Thus to fertilize 20 ovules in a particular carpel, 20 pollen grains are required.

***Q.64.Draw a labelled diagram of the L.S. of anatropous ovule and list the components of embryo sac and mention their fate after fertilization.**

Ans:

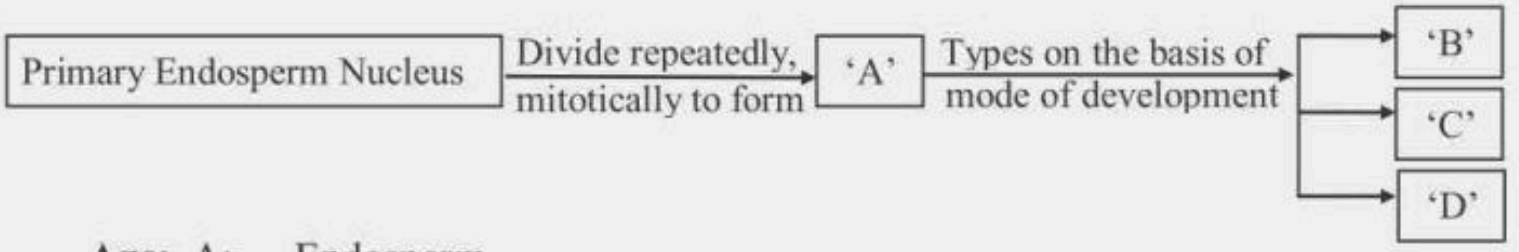
i. For diagram of L.S. of anatropous ovule: *Refer Q.28*

ii. List the components of embryo sac and mention their fate after fertilization:

Components of embryo sac	Fate after fertilization
Ovule	Seed
Egg	Embryo
Nucellus	Perisperm
Secondary nucleus	Endosperm
Outer integument	Testa (outer seed coat)
Inner integument	Tegmen (inner seed coat)
Micropyle	An opening in the seed (i.e. micropyle)
Synergids	Degenerate
Antipodals	Degenerate

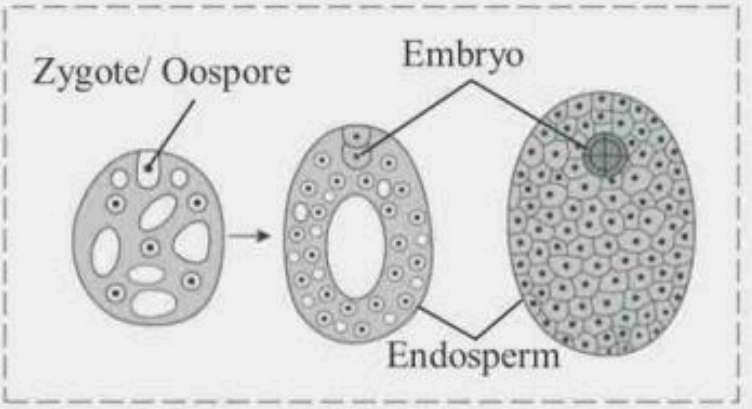
1.10 Development of Endosperm

Q.65. Complete the given flow chart and explain each type with the help of neat and labelled diagram.



Ans: A: Endosperm
B: Nuclear Type
C: Cellular Type
D: Helobial Type

i. **Nuclear Type:**



a. It is the most common type of endosperm found in 161 angiospermic families.

b. In this, the primary endosperm nucleus repeatedly divides mitotically without wall formation. Due to which large number of free nuclei are formed.

c. A big central vacuole appears in the centre of cell which pushes the nuclei towards the periphery.

d. Later, wall formation occurs between the nuclei, hence multicellular endosperm is formed.

e. But in several cases cell wall formation remains incomplete. e.g. wheat, sunflower and coconut.

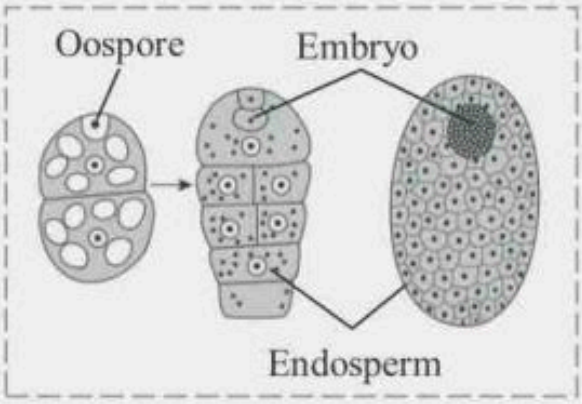
f. Coconut has multicellular endosperm in the outer part and free nuclear as well as vacuolated endosperm in the centre.

ii. **Cellular Type:**

a. In some plants, division of triploid primary endospermic nucleus is immediately followed by wall formation.

b. So that the endosperm is cellular right from the beginning.

c. It is mostly observed in 72 families of dicots as in members - *Balsam*, *Petunia*, *Adoxa*, etc.

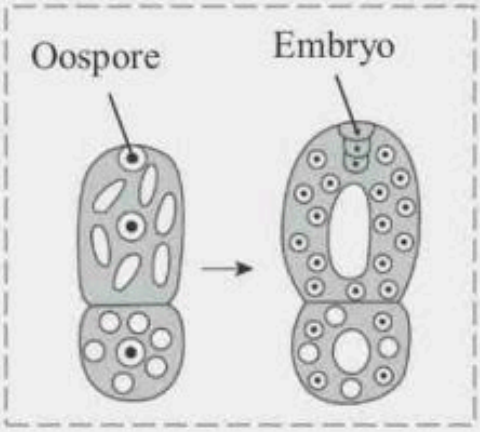


iii. **Helobial Type:**

a. It occurs in the order Helobiales of monocotyledons.

b. In this case, first division of primary endosperm nucleus is followed by a transverse wall, which divides the cell unequally.

c. The smaller cell is called chalazal cell and larger cell is the micropylar cell.



d. The nuclei in each cell divide by free nuclear divisions and then walls develop between nuclei in micropylar chamber.

e. It is intermediate between cellular and nuclear type endosperm e.g. *Asphodelus*.

Q.66. Use your brain power *(Textbook page no. 11)*

What do you call the kernel that you eat in tender coconut?

Ans: The kernel that we eat in tender coconut is a cellular endosperm.

Enrich Your Knowledge

Mosaic Endosperm:

Endosperm containing tissues of two different types is called mosaic endosperm. In plants like corn the endosperm contains patches of two different colours. It forms a sort of mosaic pattern.

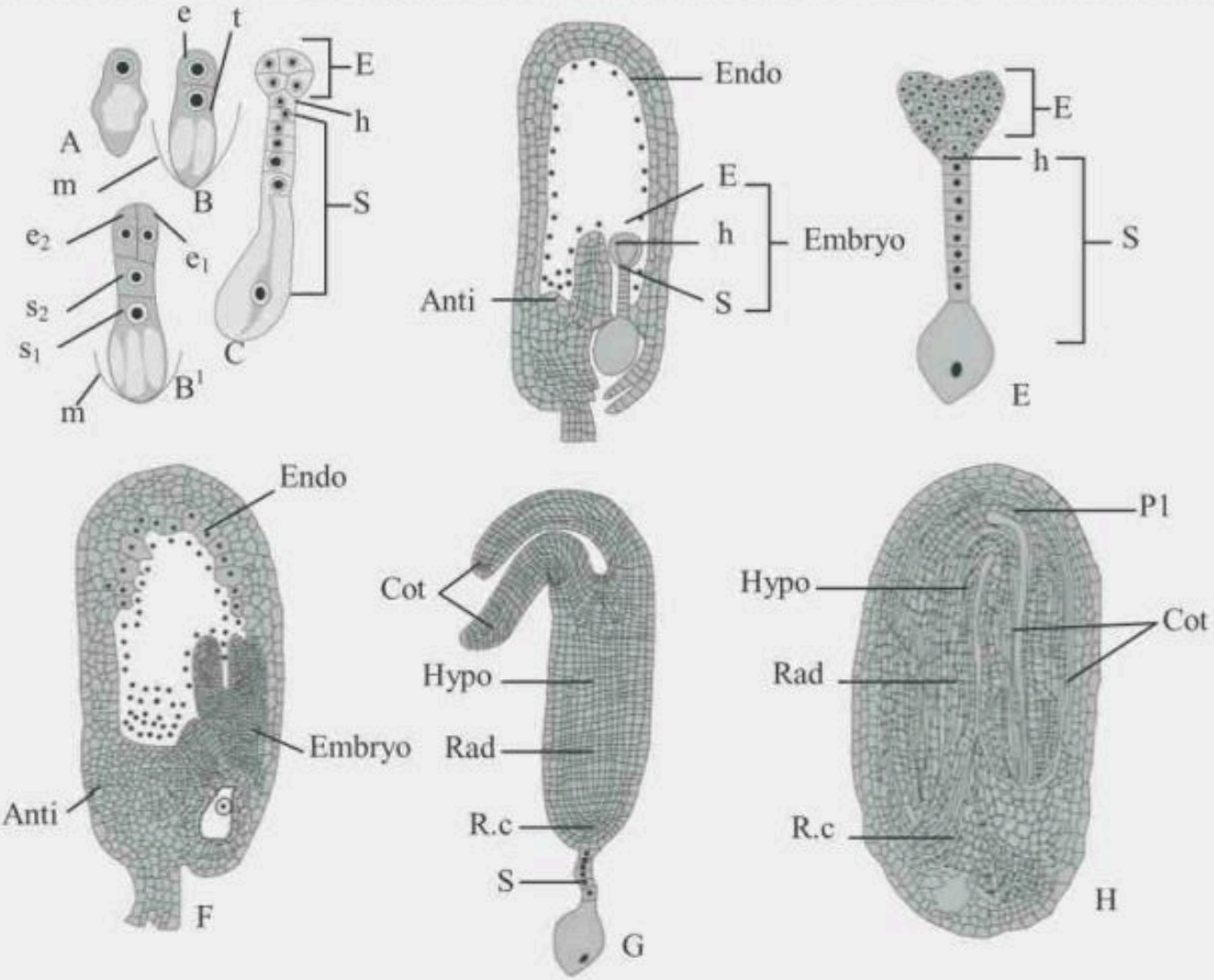
1.11 Development of Embryo

Q.67. Define embryogenesis.

Ans: The process of development of zygote into an embryo is called embryogenesis.

***Q.68. Explain the development of dicot embryo.**

Ans:



Development of Dicot Embryo as in *Capsella*

A: Oospore.
B: Two celled proembryo.
e: embryonal initial;
t: suspensor initial;
m: Embryo sac membrane.
B^1: 4-celled I-shaped proembryo;
e_1, e_2: embryonal initial; s_1, s_2 : suspensor initial.

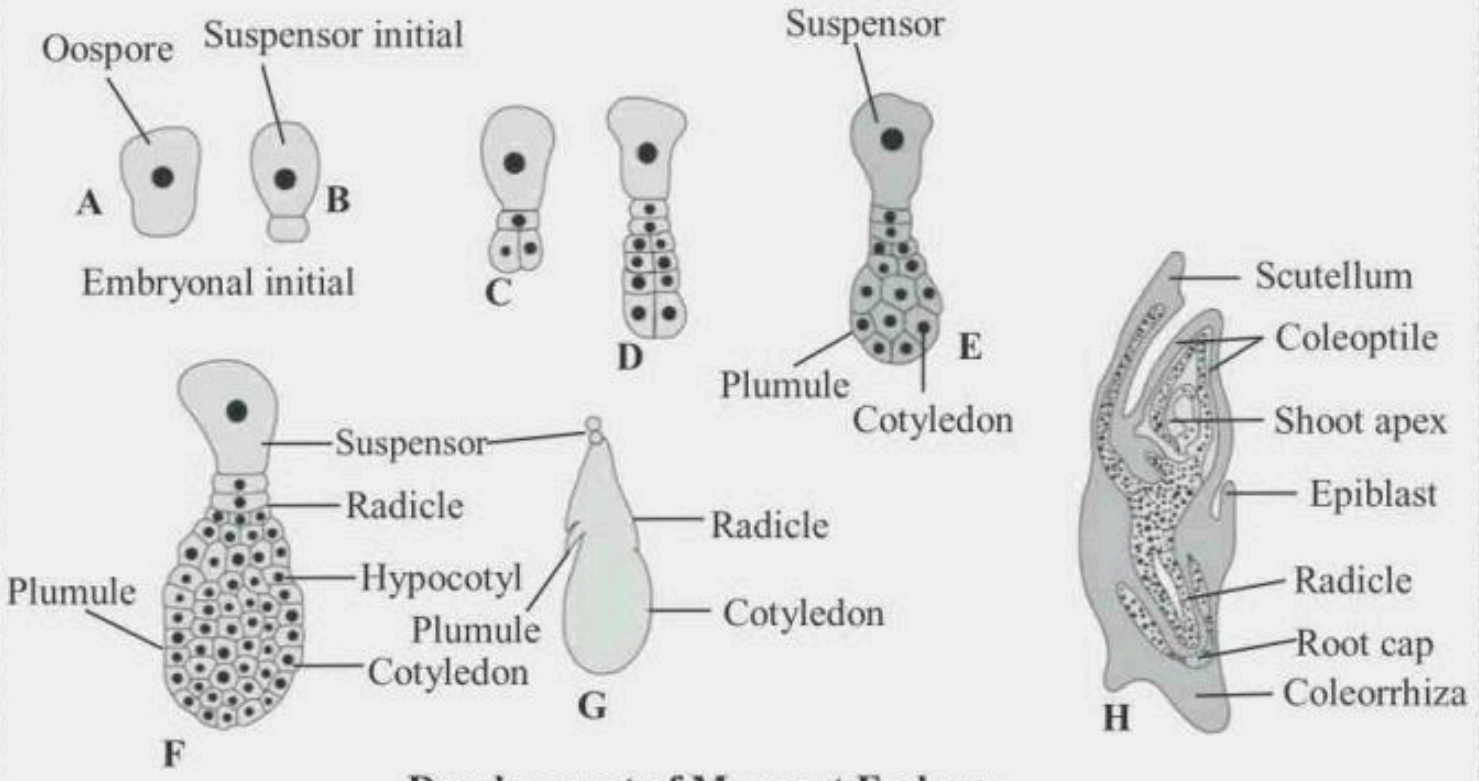
C: Further development of embryo.
S: Suspensor, h: Hypophysis; E: Embryonal mass
D: L. S. of ovule
Endo: Endosperm in free nuclear stage.
Anti: Antipodal tissue.
Embryo: Developing embryo
E: Embryo showing further development of embryonic octants and hypophysis.
F: L. S. of ovule. Endosperm becoming cellular.
G: Embryo; Cot: Cotyledons; Hypo: Hypocotyl; Rad: Radicle; R.c.: Root-cap;
H:Mature seed; Pl: Plumule. Endosperm has been consumed almost completely

Development of dicot embryo:

i. The zygote divides to form two-celled **proembryo.**
ii. The larger cell towards the micropyle is called **basal** or **suspensor initial cell** and smaller cell towards chalaza is called **terminal** or **embryonal initial cell.**
iii. The suspensor cell divides transversely in one plane to produce filamentous suspensor of 6-10 cells.
iv. The first cell of the suspensor towards the micropylar end becomes swollen and functions as a **haustorium.**
v. The lowermost cell of suspensor is known as **hypophysis.**
vi. The suspensor helps in pushing the embryo in the endosperm.
vii. The embryonal initial undergoes three successive mitotic divisions to form **octant.**
viii. The planes of divisions are at right angles to each other.
ix. The lower tier of four cells of octant give rise to **hypocotyl** and **radicle** whereas four cells of upper tier form the **plumule** and the one or two **cotyledons.**
x. The hypophysis by further division gives rise to the part of **radicle** and **root cap.**
xi. Subsequently, the cells in the upper tier of octant divide in several planes so as to become **heart shaped** which then forms two lateral cotyledons and a terminal plumule.
xii. Further enlargement of hypocotyl and cotyledons result in a curvature of embryo and it appears **horse-shoe shaped.**

Q.69. Draw the neat and labelled diagram of development of monocot embryo.

Ans:



Development of Monocot Embryo

Q.70. Describe the structure of monocot embryo.

Ans: Structure of monocot embryo:

i. In monocot embryo, single cotyledon occupies terminal position and plumule is lateral position.

ii. The single shield shaped cotyledon is called as scutellum.

iii. The protective sheath of plumule is called coleoptile and that of radicle is coleorhiza.

***Q.71. Name the parts of pistil which develop into fruits and seeds.**

Ans: After fertilization, ovary of pistil develops into fruit and ovules into seeds.

1.12 Seed and Fruit Development

***Q.72. Pollination and seeds formation are very crucial for the fruit formation. Justify the statement.**

Ans:

i. Pollination is a very important part of the life cycle of a flowering plant.
ii. The flowers must be pollinated in order to bring about the process of fertilization.
iii. Pollination brings male and female gametes of a flower together during fertilization.
iv. As a result of fertilization ovary develops into fruits and ovules into seeds.
v. Seeds on germination give rise to a new plant which further grow and develops fruits and seeds.

Thus pollination and seed formation are required to create offsprings for the next generation.

NCERT Corner

Significance of fruit formation:

i. The fruits protect the seeds from unfavorable climatic conditions.
ii. Both fleshy and dry fruits help in the dispersal of seeds to distant places.
iii. Fruits are a source of sugars, protein, oil, organic acids, vitamins and minerals.
iv. Some fruits also provide nutrition to the developing seedlings.
v. Generally hard seeds are surrounded by soft fleshy fruit pericarp (e.g.guava) and soft seeds by a hard fruit shell (e.g. almond).
vi. The fleshy, edible parts of the fruit become the source of food and energy for the animals which often act as dispersal agents.

Q.73. Define the following terms:

i. Testa ii. Tegmen iii. Perisperm

Ans:

i. **Testa:** The outer seed coat is called as testa.
ii. **Tegmen:** The inner thin, membranous seed coat is called as tegmen.
iii. **Perisperm:** The nucellus in the ovule may persist in some plants like black pepper and beet as a thin, papery layer is called as the perisperm.

Q.74. Describe the endospermic and non-endospermic seeds. Give examples of each.

Ans:

i. Endospermic seeds:
   a. In some seeds, the food reserves in the endosperm are partially used up in the development of an embryo.
   b. Thus, in such seeds the endosperm remains conspicuous and fills a greater part of the seed.
   c. Such seeds are called endospermic or albuminous seeds.
   d. In endospermic seeds, cotyledons act as a first photosynthetic organs. (It means, on germination cotyledons forms first embryonic leaves of a seedling.)
   e. e.g. Castor, Coconut, Maize, etc.

ii. Non-endospermic seeds:
   a. In some seeds, embryo absorbs food reserve from the endosperm completely during its developmental stages.
   b. Thus, endosperm disappears (disorganizes) in mature seeds.
   c. Such seeds are called non-endospermic or exalbuminous seeds.
   d. In some non-endospermic seeds, cotyledons acts as a food storage organ.
   e. e.g. Pea, bean, etc.

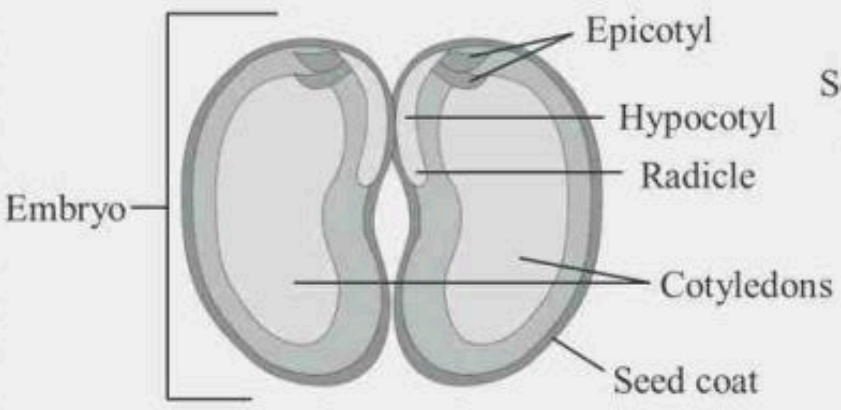
Q.75. What is micropyle? Write its function.

Ans:

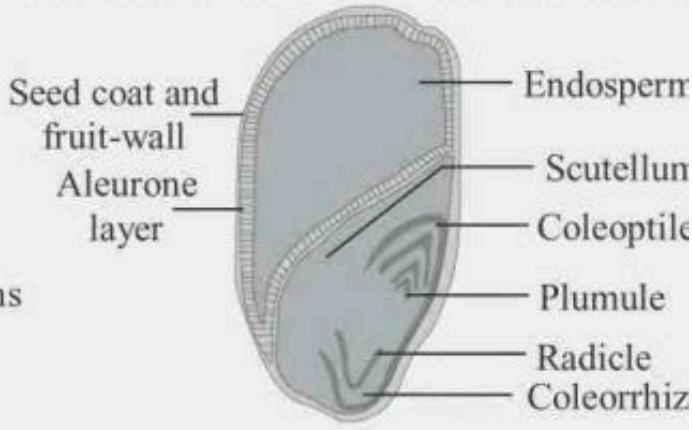
i. Micropyle is a small pore in seed coat.
ii. It allows the entry of water and oxygen during germination.

Q.76. Draw neat and labelled diagram of dicot seed and monocot seed.

Ans:

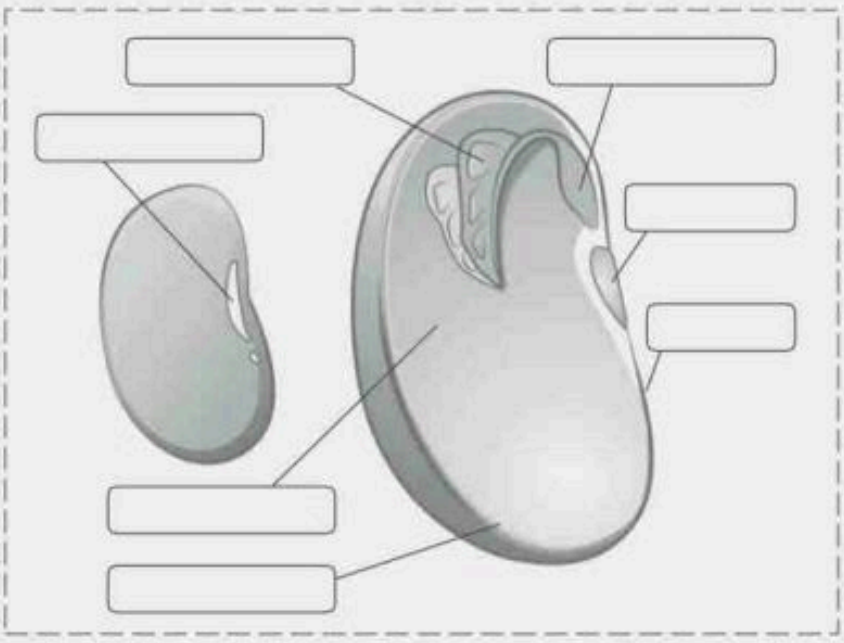


Bean seed (Dicot)

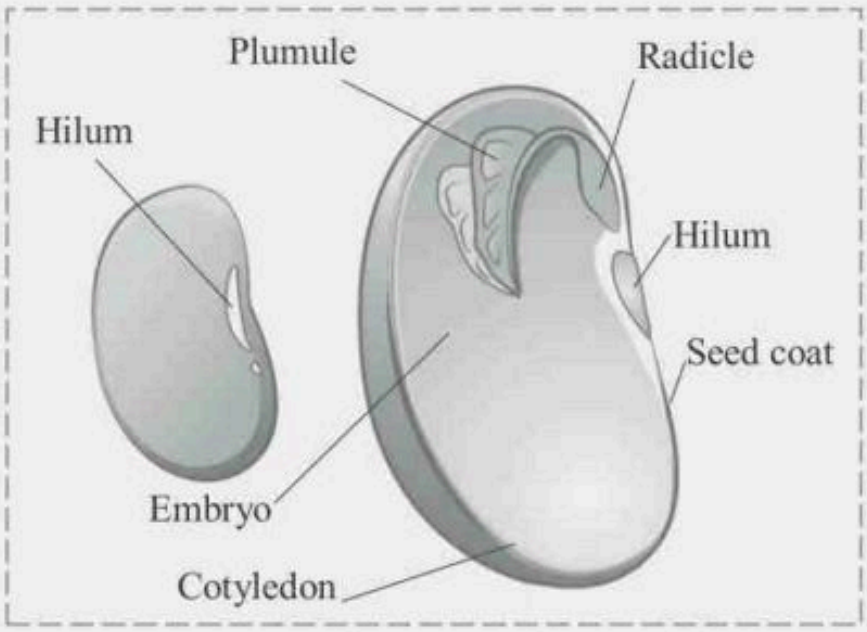


Maize seed (Monocot)

***Q.77. Label the parts of seed.**



Ans:



Q.78. Can You Recall? *(Textbook page no. 14)*

i. What are the parts of the fruit?

ii. What is the difference between true fruit and false fruit?

Ans:

i. The parts of the fruit are **Pericarp** (Fruit wall) and **seeds**.
Pericarp consists of three layers called as **epicarp** (outer layer), **mesocarp** (middle layer) and **endocarp** (inner layer).

ii. A true fruit is the one which develops from a single ovary of a single flower. e.g. mango, whereas a false fruit is the one in which other floral parts (e.g. thalamus) take part in the formation of fruit.
e.g. apple, strawberry, cashew.

Q.79. Write the significance of seed and fruit.

Ans: Significance of seed and fruit:

i. Fruits provide nourishment to the developing seeds.
ii. Fruits protect the seeds in immature condition.
iii. Seeds serve as important propagating organs (units) of plant.
iv. Seeds and fruits develop special devices for their dispersal and thus help in the distribution of the species.

Q.80. Try This *(Textbook page no. 14)*

Help to rebuild natural ecosystem. Mix seeds and potting soil together with dry clay. Mould the mixture into small balls and allow them to dry in sun. Throw the same at places suitable for germination.

Ans: The small balls made by mixing seeds, potting soil and dry clay are usually termed as **seed balls** or **earth balls**. This technique helps to conserve seeds and protect them from heat, wind and birds. Seed balls can be thrown to a suitable place for germination.

*[**Note:** Students are expected to perform this activity on their own.]*

*[**Note:** Students can click on the adjacent QR code to get information about **Seed balls.**]*

Q.81. What is Dormancy? Explain it with respect to seeds.

Ans:

i. Dormancy is a state of metabolic arrest that facilitates the survival of organisms during adverse environmental conditions.
ii. Structural or physiological adaptive mechanism for survival is called dormancy.
iii. Mature and viable seeds will not germinate even in the presence of favourable conditions and they are dispersed at different places during dormancy.
iv. Viable seeds germinate only after completion of dormancy period.

Q.82. Think about it *(Textbook page no. 14)*

i. How long seeds stay viable/ healthy?

ii. Can old seeds still grow?

Ans:

i. Generally seeds can stay viable/healthy up to 1-2 years. However it differs from plant to plant.

Some seeds are short lived e.g. *Citrus*, while some are found to be viable after thousands of years e.g. *Lupinus arcticus* - 10,000 years, *Phoenix dactylifera* - 2000 years.

ii. Old seeds can grow if they are provided with conditions favourable for germination.

However, it depends on viability period of seeds which is different for each plant.

1.13 Apomixis

Q.83. What is Apomixis? Write its advantage.

Ans: Apomixis:

i. The phenomenon of formation of embryo(s) through asexual method of reproduction without formation of gametes and the act of fertilization is called as Apomixis.

ii. Alternatively, it is unusual sexual reproduction where there is no meiosis and syngamy.

iii. Embryo develops in the ovule and ovule develops to form seed.

iv. Advantage: Genetically identical plants can be produced effectively and rapidly by apomixis.

Enrich Your Knowledge

Apomixis:

i. Apomixis is a form of asexual reproduction that mimics sexual reproduction in higher plants.

ii. The organism that can reproduce by apomixis is called as an apomict.

iii. It has been reported particularly in grasses and also in few flowering plants of family Asteraceae.

Q.84. Define the terms: Apogamy and Apospory

i. Apogamy: In apomixis, when a gametophyte organ or cell produces embryo like structure without fertilization, it is termed as apogamy.

ii. Apospory: In apomixis, when diploid sporophyte cell produces a diploid gametophyte without undergoing meiosis is called apospory.

***Q.85. Are pollination and fertilization necessary in apomixis?**

Ans: In apomixis, embryo is formed without formation of gametes and fertilization.

Thus, pollination and fertilization are not necessary in apomixis.

Q.86. Explain the categories of apomixis.

Ans: **Categories of apomixis:**

i. **Recurrent apomixis:**
   a. In this type, the embryo sac generally rise either from an archesporial cell or from some other part of the nucellus.
   b. In **diplospory**, the unreduced embryo sac is derived from the diploid megaspore mother cell e.g. *Taraxacum*.
   c. In **apospory**, the nucellar cells give rise to apomictic embryo sac.

ii. **Non-recurrent apomixis:**
   a. In this type, megaspore mother cell undergoes usual meiotic division and a haploid embryo sac is formed.
   b. Here, the embryo arises either from the egg by parthenogenesis or from some other haploid cells of gametophyte through **apogamy**.
   c. Plants produced by this method are generally sterile and do not reproduce sexually, e.g. *Nicotiana*.

iii. **Adventive Embryony:**
   a. In this type, embryos may develop from somatic nucellus or integuments along with normal zygotic embryo.
   b. It is common in Mango, Orange, Lemon, etc. It gives rise to a condition called **polyembryony**.

Q.87. Internet my friend *(Textbook page no. 14)*

Collect information about seed mother Rahibai's story. How does she save over 80 varieties of native seeds?

Ans: **Rahibai Soma Popere** is an Indian farmer and is known for Conservation of indigenous plant varieties.

Scientist Raghunath Mashelkar gave her the epithet "Seed Mother".

She has received many awards like Padma Shri, Nari Shakti Puraskar for her efforts to save indigenous seeds and promoting traditional farming.

She believes that native seeds have several advantages when compared to hybrid seeds, thus she developed seed bank of native plant varieties.

Besides conserving seeds, she spreads awareness about the importance of conserving indigenous seeds, organic farming, agro-biodiversity and wild food resources.

Rahibai now trains farmers and students on seed selection, techniques to improve soil fertility, etc.

She also supplies farmers with seedlings of native crops.

*[**Note:** Students can collect more information about seed mother Rahibai from internet.]*

1.14 Parthenocarpy

Q.88. Write a short note on parthenocarpy.

Ans: Parthenocarpy:

i. The term Parthenocarpy was coined by Noll (1902).

ii. It is the condition in which fruit is developed without the process of fertilization.

iii. It occurs naturally in some varieties of Pineapple, Banana, Papaya, etc.

iv. In these plants, the placental tissue in the unfertilized ovary produces auxin IAA (Indole-3 Acetic Acid) which is responsible for enlargement of ovary into fruit.

v. Parthenocarpic fruit resembles the normally produced fruit but it is seedless.

***Q.89. Define Parthenocarpy.**

Ans: *Refer Q.88 (ii)*

Q.90. Use your brain power *(Textbook page no. 15)*

What do bananas and figs have in common?

Ans: The cultivated fruits like banana and figs are developed without fertilisation and do not produce any viable seeds. Thus, banana and figs are examples of parthenocarpic fruits.

Q.91. How parthenocarpy can be induced artificially?

Ans: Parthenocarpy can be induced artificially by spraying of gibberellins, delaying pollination, use of foreign pollens, etc.

1.15 Polyembryony

Q.92. Think about it *(Textbook page no. 15)*

Why are some seeds of *Citrus* referred to as polyembryonic?

Ans: Some seeds of *Citrus* are referred to as polyembryonic because they contain more than one embryos.

Q.93. Explain polyembryony in detail.

Ans: **Polyembryony:**

i. Polyembryony is the development of more than one embryos, inside the seed.

ii. It was first noticed by Leeuwenhoek (1719) in the seeds of *Citrus* genus.

iii. It is the occurrence of more than one embryo in a seed which consequently results in the emergence of multiple seedlings.

iv. The additional embryos result from the differentiation and development of various maternal and zygotic tissues associated with the ovule of seed.

v. Polyembryony may be true or false depending upon whether many embryos arise in the same embryo sac or in different embryo sacs in the same ovule.

vi. In **adventive polyembryony**, an embryo develop directly from the diploid cell of nucellus and integuments as in *Citrus*.

vii. In **cleavage polyembryony**, zygote proembryo sometimes divides (cleaves) into many parts or units. Each unit then develops into an embryo.

Q.94. How polyembryony can be commercially exploited?

Ans:

i. Polyembryony increases the chances of survival of the new plants.

ii. Genetically uniform parental type seedlings are obtained from nucellar embryos, thus nucellar adventive polyembryony is of great significance in horticulture.

iii. Plantlets obtained from these embryos are disease free.

iv. These embryos can be isolated and grown on embryo culture to produce clones.

Q.95. Define agamospermy.

Ans: It is phenomenon in which plants produce seeds, but embryo, inside it, is produced without meiosis and syngamy.

OR

It is asexual reproduction in which seeds are produced from unfertilized ovules.

***Q.96. Fill in the blanks.**

i. The _____ collects the pollen grains.
ii. The male whorl, called the _____ produces _____.
iii. The pollen grains represent the _____
iv. The _____contains the egg or ovum.
v. _____takes place when one male gamete and the egg fuse together. The fertilised egg grows into seed from which the new plants can grow.
vi. _____is the transfer of pollen grains from anther of the flower to the stigma of the same or a different flower.
vii. Once the pollen reaches the stigma, pollen tube traverses down the _____to the ovary where fertilisation occurs.
viii. The _____is the base of the flower to which other floral parts are attached.
ix. The _____are coloured to attract the insects that carry the pollen. Some flowers also produce _____or _____that attracts insects.
x. The whorl _____is green that protects the flower until it opens.

Ans:

i. The **stigma** collects the pollen grains.
ii. The male whorl, called the **androecium** produces **pollen grains**.
iii. The pollen grains represent the **male gametophyte**.
iv. The **embryo sac** contains the egg or ovum.
v. **Syngamy (fertilization)** takes place when one male gamete and the egg fuse together. The fertilised egg grows into seed from which the new plants can grow.

vi. **Pollination** is the transfer of pollen grains from anther of the flower to the stigma of the same or a different flower.

vii. Once the pollen reaches the stigma, pollen tube traverses down the **style** to the ovary where fertilisation occurs.

viii. The **thalamus** is the base of the flower to which other floral parts are attached.

ix. The **petals** are coloured to attract the insects that carry the pollen. Some flowers also produce **sweet odour** or **nectar** that attracts insects.

x. The whorl **calyx** is green that protects the flower until it opens.

***Q.97. Match the columns.**

	Column - I (Structure before seed formation)		Column - II (Structure after seed formation)
A.	Funiculus	I.	Hilum
B.	Scar of ovule	II.	Tegmen
C.	Zygote	III.	Testa
D.	Inner integument	IV.	Stalk of seed
		V.	Embryo

a. A - V, B - I, C - II, D - IV

b. A - III, B - IV, C - I, D - V

c. A - IV, B - I, C - V, D - II

d. A - IV, B - V, C - III, D - II

Ans: **The correct answer is:** c. A - IV, B - I, C - V, D – II

Practical / Project

***Q.102. Natural vegetative propagation by leaves only in different vascular plants.**

Ans: **Vegetative propagation by Leaf:**

i. In some plants like *Bryophyllum*, leaves take part in vegetative propagation.

ii. Adventitious buds called epiphyllous buds are developed on the leaves. These buds start sprouting on the leaf to form the plantlets.

iii. These plantlets fall off from parent plant to continue their growth in the wet soil.

*[**Note**: Students are expected to collect more information about Natural vegetative propagation by leaves only in different vascular plants.]*

Apply Your Knowledge

Q.98. How many meiotic divisions are required to form the following number of pollen grains and female gametophytes:
28, 52, 72, 100

Ans:

Number of pollen grains and female gametophytes	Number of meiotic divisions required form pollen grains	Number of meiotic divisions required form female gametophytes
28	7	28
52	13	52
72	18	72
100	25	100

[**Hint:** Each diploid microspore mother cell (2n) undergoes meiotic division to form four haploid microspores (n) or pollen grains.

1 Megaspore mother cell $\xrightarrow{\text{Meiosis}}$ 4 Megaspores

(MMC) $\xrightarrow{\text{3 degenerate}}$ 1 Functional megaspore]

Q.99. An angiospermic plant has 10 flowers. Each flower has 10 stamens in which anthers are tetrasporangiate. Each pollen chamber has 10 microspore mother cells. How many total pollen grains will that plant produce?

Ans: Two anther lobes contain 4 pollen sacs. Each pollen sac has 10 microspore mother cells.

Each diploid microspore mother cell (2n) undergoes meiotic division to form four haploid pollen grains (n).

4 pollen sacs $\rightarrow$ 40 microspore mother cells $\rightarrow$ 160 pollen grains

160 pollen grains will be produced by one stamen.

10 stamens $\rightarrow$ 1600 pollen grains

Each flower has 10 stamens and there are 10 such flowers.

$\therefore$ $1600 \times 10 = 16000$ pollen grains.

Q.100. If a tetraploid male flower fertilizes a diploid female flower find the ploidy of zygote and endosperm.

Ans: A tetraploid male flower will produce two diploid male gametes, i.e. 2n and 2n.

A diploid female flower will produce one haploid egg (n), and diploid secondary nucleus (2n).

Zygote $\rightarrow$ (2n) + (n) = 3n

Endosperm $\rightarrow$ (2n) + (2n) = 4n

Q.101. If there are 48 chromosomes in a bisexual plant, how many chromosomes will be present in:

i. Root **ii. Stem**

iii. Leaf **iv. Ovary**

v. Pollen **vi. Antipodals**

vii. Endosperm

Ans:

No.	Part	Ploidy	No. of chromosomes present
i.	Root	2n	48
ii.	Stem	2n	48
iii.	Leaf	2n	48
iv.	Ovary	2n	48
v.	Pollen	n	24
vi.	Antipodals	n	24
vii.	Endosperm	3n	72

Quick Review

Reproduction

- Asexual
  - Fragmentation
  - Budding
  - Spore formation
  - Binary fission
  - Conidia formation
  - Gemmule formation
- Vegetative Reproduction
  - Natural
  - Artificial
    - Cutting
    - Grafting
    - Tissue Culture
- Sexual

Parts of a flower

- Calyx (Sepals)
- Corolla (Petals)
- Androecium (Stamen)
  - Filament
  - Connective
  - Anther
- Gynoecium (Carpel)
  - Ovary
  - Style
  - Stigma

Microsporogenesis

Microspore mother cells (2n) $\xrightarrow[\text{meiotically}]{\text{divide}}$ Tetrad of Pollen grain (n)

Development of male gamete

Pollen grain $\xrightarrow[\text{division}]{1^{st}\text{ mitotic}}$ Vegetative Cell + Generative Cell $\xrightarrow[\text{division}]{2^{nd}\text{ mitotic}}$ 2 non-motile male gametes

Megasporogenesis

Megaspore mother cell (2n) —divides meiotically→ 4 Megaspores (n)

Development of female gametophyte

1 Functional Megaspore —Undergoes three mitotic divisions→ 8 nucleated, 7 celled Embryo sac

Pollination

- Abiotic agents
  - Wind (Anemophily)
  - Water (Hydrophily)
- Biotic agents
  - Insects (Entomophily)
  - Birds (Ornithophily)
  - Bats (Chiropterophily)

Outbreeding Devices

- Unisexuality
- Dichogamy
- Prepotency
- Heterostyly
- Herkogamy
- Self incompatibility

Double fertilization

- Syngamy (male gamete + egg) → Zygote
- Triple fusion (male gamete + Secondary nucleus) → Primary Endosperm Nucleus

Types of endosperm

- Nuclear
- Cellular
- Helobial

Types of Seeds

- Endospermic/ Albuminous
  e.g. Caster, Coconut, Maize
- Non-endospermic/ Ex-albuminous
  e.g. Pea, bean

Apomixis

Formation of embryo(s)
through asexual method of reproduction

Categories

- Recurrent
- Non-recurrent
- Adventive Embryony

Parthenocarpy

Fruits develop without fertilization

Polyembryony

Development of more than one embryos in seed

Exercise

1.1 Asexual Reproduction

1. What are the two methods of reproduction?
Ans: *Refer Q.2.(ii)*

2. Describe the methods of asexual reproduction in lower organisms.
Ans: *Refer Q.4.(ii)*

3. Explain the advantages of asexual reproduction in horticulture.
Ans: *Refer Q.10.*

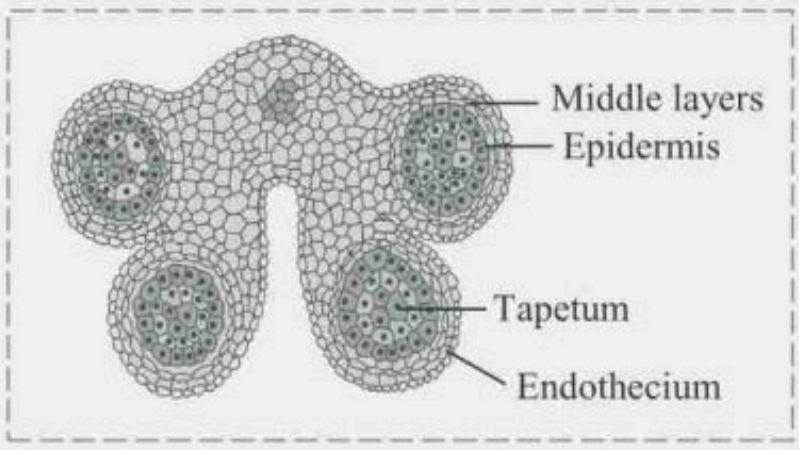
4. How yeast reproduce asexually?
Ans: *Refer Q.4.(ii-b)and Q.5 (A) Figure*

5. Explain the artificial methods of vegetative propagation.
Ans: *Refer Q.9.*

1.2 Sexual Reproduction

6. Draw neat and labelled diagram of parts of a flower.
Ans: *Refer Q.12.*

7. Identify the incorrect labels in the given figure of T.S. of anther.



Ans: *Refer Q.18.*

8. What is tetrasporangiate anther?
Ans: *Refer Q.17.(iv)*

9. *Write a short note on anther wall.*
Ans: *Refer Q.18.(ii)*

10. Explain the role of tapetum in the formation of pollen-grain wall. **[NCERT]**
Ans: *Refer Q.19.*

1.3 Microsporogenesis

11. What is microsporogenesis?
Ans: *Refer Q.20.*

12. Describe the structure of microspore in detail.
Ans: *Refer Q.21.*

13. What are germ pores? State their function.
Ans: *Refer Q. 21.(iv-d, e)*

14. With the help of neat and labelled diagram explain how microspore develops into a male gametophyte?
Ans: *Refer Q.25.*

1.4 Structure of Anatropus Ovule

15. Define the following terms:
i. Apocarpous flower ii. Syncarpous flower
Ans: i. *Refer Q.27 (iii)* ii. *Refer Q.27 (iv)*

16. Draw neat and labelled diagram of an anatropous ovule.
Ans: *Refer Q.28 (Diagram)*

17. What is micropyle?
Ans: *Refer Q.28 (vi)*

1.5 Megasporogenesis

18. Explain in detail the development of female gametophyte from megaspore.
Ans: *Refer Q.30.*

19. Why development of female gametophyte is called monosporic and endosporic? **[NCERT]**

Ans: *Refer Q.30. (xii, xiii)*

1.6 Pollination

20. Define the following terms:
    i. Pollination ii. Self-pollination
    iii. Cross pollination

Ans: i. *Refer Q.34 (i).* ii. *Refer Q.35.(i)* iii. *Refer Q.35.(ii)*

21. What is cleistogamy?

Ans: *Refer Q.36.(ii)*

22. Explain how anemophilous plants are adapted to wind pollination?

Ans: *Refer Q.43.(ii)*

23. Write a short note on epihydrophily.

Ans: *Refer Q.46.(ii)*

24. Define entomophily.

Ans: *Refer Q.49.(i)*

25. Enlist adaptations in chiropterophilous flowers.

Ans: *Refer Q.53.(ii)*

1.7 Outbreeding Devices (Contrivances)

26. Explain in detail outbreeding devices in plants to avoid self-pollination.

Ans: *Refer Q.54.*

1.8 Pollen-Pistil Interaction

27. Describe pollen pistil interaction.

Ans: *Refer Q.55.*

1.9 Double Fertilization

28. Draw neat and labelled diagram of double fertilization .

Ans: *Refer Q.60.*

29. Describe the process of double fertilization and give its significance.
Ans: *Refer Q.60, and Q.62*

1.10 Development of Endosperm

30. Write a short note on helobial type of endosperm.
Ans: *Refer Q.65 (iii)*

1.11 Development of Embryo

31. What is embryogenesis? Explain it with the help of dicot embryo.
Ans: *Refer Q.67, and Q.68*

1.12 Seed and Fruit Development

32. Name the outer and inner seed coat.
Ans: *Refer Q.73 (i, ii)*

33. What are non-endospermic seeds?
Ans: *Refer Q.74 (ii)*

34. Define dormancy.
Ans: *Refer Q.81 (i)*

1.13 Apomixis

35. What is apomixis and what is its importance? **[NCERT]**
Ans: *Refer Q.83*

1.14 Parthenocarpy

36. What is parthenocarpy?
Ans: *Refer Q.88*

1.15 Polyembryony

37. Write a short note on polyembryony.
Ans: *Refer Q.93*

Multiple Choice Questions

1. *Chlamydomonas* reproduce asexually by
   (A) binary fission (B) spore formation
   (C) budding (D) gemmule formation

2. In grafting, the part of stem containing more than one bud called _____ is joined onto a rooted plant.
   (A) stock (B) cutting
   (C) scion (D) clone

3. All the given below are parts of stamen, except
   (A) filament (B) style
   (C) connective (D) anther

4. A dithecous anther is
   (A) unisporangiate (B) trisporangiate
   (C) bisporangiate (D) tetrasporangiate

5. _____ layer of anther wall immediately encloses the sporogenous tissue.
   (A) middle (B) tapetum
   (C) endothecium (D) epidermis

6. The exine of an anther is made up of complex, non-biodegradable substance called
   (A) tapetum (B) sporopollenin
   (C) pectin (D) cellulose

7. A typical carpel has three parts viz. ovary, style and _____
   (A) vegetative cell (B) micropyle
   (C) stigma (D) chalaza

*8. In ovule, meiosis occurs in
   (A) integument (B) nucellus
   (C) megaspore (D) megaspore mother cell

9. Synergids show hair like projections called
   (A) antipodals (B) polar nuclei
   (C) filiform apparatus (D) funiculus

*10. Point out the odd one.
(A) Nucellus (B) Embryo sac
(C) Micropyle (D) Pollen grain

11. In angiosperms, _____ is a pre-requisite for fertilization because both male and female gametes are non- motile.
(A) pollination (B) syngamy
(C) triple fusion (D) parthenocarpy

12. The contrivances that favour self-pollination are
(A) bisexuality (B) homogamy
(C) cleistogamy (D) all of these

13. Which of the following plant shows geitonogamy?
(A) Pea (B) *Cucurbita maxima*
(C) *Vallisneria* (D) *Zostera*

*14. Which of the following types require pollinator but result is genetically similar to autogamy?
(A) Geitonogamy (B) Xenogamy
(C) Apogamy (D) Cleistogamy

15. Which of the following is not an adaptation in anemophilous flowers?
(A) Small, inconspicuous, colourless flowers
(B) Dry pollen grains produced in large numbers
(C) Flowers with nectar gland
(D) Feathery stigma

16. Which of the following aquatic plant is anemophilous?
(A) *Potamogeton* (B) Lotus
(C) Water hyacinth (D) Water lily

*17. Insect pollinated flowers usually posses
(A) Sticky pollens with rough surface
(B) Large quantities of pollens
(C) Dry pollens with smooth surface
(D) Light coloured pollens

18. Pollination by bats is called as
(A) Ornithophily (B) Anemophily
(C) Chiropterophily (D) Entomophily

*19. The ploidy level is NOT the same in
(A) Integuments and nucellus
(B) Root tip and shoot tip
(C) Secondary nucleus and endosperm
(D) Antipodals and synergids

20. When pollen tube enters ovule through integuments it is called as
(A) syngamy (B) porogamy
(C) chalazogamy (D) mesogamy

*21. In angiosperms, endosperm is formed by/ due to
(A) free nuclear divisions of megaspore
(B) polar nuclei
(C) polar nuclei and male gamete
(D) synergids and male gamete

22. The triploid primary endosperm nucleus repeatedly divides mitotically to form nutritive tissue called
(A) embryo (B) zygote
(C) endosperm (D) nucellus

23. The type of endosperm in which division of triploid primary endosperm nucleus is immediately followed by wall formation is called _____ endosperm.
(A) nuclear (B) cellular
(C) helobial (D) mosaic

24. After fertilization, ovary wall develops into
(A) pericarp (B) perisperm
(C) testa (D) tegmen

*25. If diploid chromosome number in a flowering plant is 12, then which one of the following will have 6 chromosomes?
(A) Endosperm (B) Leaf cells
(C) Cotyledons (D) Synergids

26. Tiny seeds of these plants are easy for dispersal, except
(A) *Striga* (B) Orchids
(C) *Citrus* (D) *Orobancha*

27. Polyembryony is commonly observed in
(A) mango (B) orange
(C) lemon (D) all of these

Answers to Multiple Choice Questions

1.	(B)	2.	(C)	3.	(B)	4.	(D)	5.	(B)	6.	(B)
7.	(C)	8.	(D)	9.	(C)	10.	(D)	11.	(A)	12.	(D)
13.	(B)	14.	(A)	15.	(C)	16.	(A)	17.	(A)	18.	(C)
19.	(C)	20.	(D)	21.	(C)	22.	(C)	23.	(B)	24.	(A)
25.	(D)	26.	(C)	27.	(D)						

Competitive Corner

1. Which is the most common type of embryo sac in angiosperms? **[NEET Odisha 2019]**
   (A) Bisporic with two sequential mitotic divisions
   (B) Tetrasporic with one mitotic stage of divisions
   (C) Monosporic with three sequential mitotic divisions
   (D) Monosporic with two sequential mitotic divisions

2. What type of pollination takes place in *Vallisneria*? **[NEET Odisha 2019]**
   (A) Male flowers are carried by water currents to female flowers at surface of water.
   (B) Pollination occurs in submerged condition by water.
   (C) Flowers emerge above surface of water and pollination occurs by insects.
   (D) Flowers emerge above water surface and pollen is carried by wind.

3. What is the fate of the male gametes discharged in the synergid? **[NEET (UG) 2019]**
   (A) One fuses with the egg, other(s) fuse(s) with synergid nucleus.
   (B) One fuses with the egg and other fuses with central cell nuclei.
   (C) One fuses with the egg, other(s) degenerate(s) in the synergid.
   (D) All fuse with the egg.

4. Which one of the following statements regarding post-fertilization development in flowering plants is INCORRECT? **[NEET (UG) 2019]**
   (A) Central cell develops into endosperm
   (B) Ovules develop into embryo sac
   (C) Ovary develops into fruit
   (D) Zygote develops into embryo

Hint: Ovules develop into seeds.

5. In some plants, the female gamete develops into embryo without fertilization. This phenomenon is known as: **[NEET (UG) 2019]**
   (A) syngamy
   (B) parthenogenesis
   (C) autogamy
   (D) parthenocarpy

6. Persistent nucellus in the seed is known as: **[NEET (UG) 2019]**
   (A) Hilum (B) Tegmen
   (C) Chalaza (D) **Perisperm**

7. If the number of chromosomes in an endosperm of seed is 21, what will be the chromosome number in the secondary nucleus? **[MHT CET 2019]**
   (A) 7 (B) 28
   (C) **14** (D) 21

Hint: Endosperm of seed is triploid, hence $3n = 21$
Whereas secondary nucleus is diploid, hence $2n = 14$.

8. For the formation of 140 angiospermic seeds how many meiotic cell divisions are expected? **[MHT CET 2019]**
   (A) **175** (B) 280
   (C) 560 (D) 240

Hint: For formation of 140 angiospermic seeds 140 male gametes and 140 female gametes are required.
For formation of 140 male gametes, the number of meiotic divisions required will be 35.
(1 Microspore mother cell $\xrightarrow{\text{meiosis}}$ 4 microspores)
For formation of 140 female gametes, the number of meiotic divisions required will be 140.
(1 Megaspore mother cell $\xrightarrow{\text{meiosis}}$ 4 megaspores $\xrightarrow{\text{3 degenerate}}$ 1 functional megaspore)
Therefore, for the formation of 140 angiospermic seeds 175 meiotic cell divisions are expected.

9. In angiosperms, a male gametophyte is developed from a pollen mother cell by _____. **[MHT CET 2019]**
   (A) **one meiotic and two mitotic divisions**
   (B) two mitotic divisions
   (C) one mitotic and two meiotic divisions
   (D) a single meiotic division

Time: 1 Hour 30 Min | **TOPIC TEST** | Total Marks: 25

SECTION A

Q.1. Select and write the correct answer: [04]

i. _____ is the innermost nutritive layer of anther wall.
(A) Endothecium (B) Epidermis
(C) Tapetum (D) Middle layer

ii. A narrow opening at the apex of an ovule is called
(A) chalaza (B) micropyle
(C) nucellus (D) hilum

iii. Pollination by insect is called as
(A) chiropterophily (B) entomophily
(C) anemophily (D) hydrophily

iv. Which of the following is an ex-albuminous seed?
(A) castor (B) coconut
(C) maize (D) pea

Q.2. Answer the following [03]

i. Define megasporogenesis.

ii. Give any two examples of plants in which pollination occurs by water.

iii. What is coleoptile and coleorhiza?

SECTION B

Attempt any Four: [08]

Q.3. Draw neat and labelled diagram of maize seed.

Q.4. Write any four adaptations of hydrophilous flowers.

Q.5. Write a short note on grafting.

Q.6. What is cellular type endosperm? Name any two plants which possess this type of endosperm.

Q.7. Write significance of seed and fruit formation.

Q.8. Development of female gametophyte in angiosperm is monosporic and endosporic. Give reason.

SECTION C

Attempt any Two: **[06]**

Q.9. What are endospermic seeds? Give two examples.

Q.10. Explain the term parthenocarpy.

Q.11. Draw neat and labelled diagram of T.S. of anther.

SECTION D

Attempt any One: **[04]**

Q.12. Explain the process of double fertilization.

Q.13. Explain in detail structure of an anatropous ovule.

Answers

SECTION A

Q.1.

i. **(C)** Tapetum *[1 Mark]*

ii. **(B)** micropyle *[1 Mark]*

iii. **(B)** entomophily *[1 Mark]*

iv. **(D)** pea *[1 Mark]*

Q.2.

i. **Megasporogenesis:**
It is the process of formation of haploid megaspores from diploid megaspore mother cell (MMC) by meiotic division. *[1 Mark]*

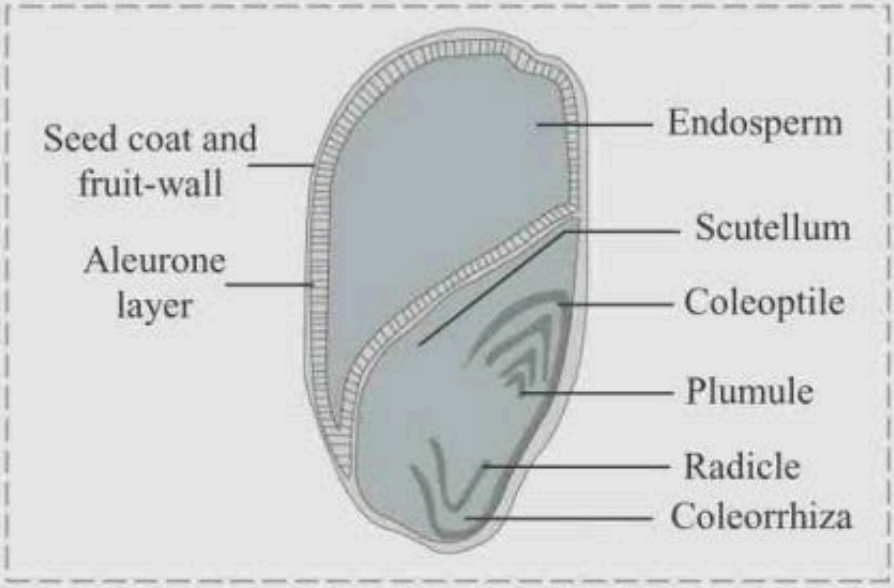
ii. In *Vallisneria*, *Zostera*, *Ceratophyllum* etc. pollination occurs by water. *[Any two examples]* *[1 Mark]*

iii. The protective sheath of plumule is called coleoptile and that of radicle is coleorhiza. *[1 Mark]*

SECTION B

Attempt any Four

Q.3.



[2 Marks]

Q.4. **Adaptations in hydrophilous flowers:**

i. Flowers are small and inconspicuous.
ii. Perianth and other floral parts are unwettable.
iii. Pollen grains are long and unwettable due to presence of mucilage.
iv. Nectar and fragrance are lacking in flowers.

[2 Marks]

Q.5. **Grafting:**

i. In this parts of two plants are joined in such a way that they grow as one plant.
ii. Part of the rooted plant on which grafting is done is called **stock** (root stock).
iii. While the part which is inserted on stock is called **scion** (graft).
iv. Budding is also called **bud grafting** in which single bud is a scion.
v. A single bud is then inserted in the slit of the stock.
vi. Grafting is done in plants like Apple, Rose, Pear, etc.

[2 Marks]

Q.6. **Cellular Type endosperm:**

i. In some plants, division of triploid primary endospermic nucleus is immediately followed by wall formation.
ii. So that the endosperm is cellular right from the beginning.
iii. It is mostly observed in 72 families of dicots as in members - *Balsam*, *Petunia*, *Adoxa*, etc.

[Any two plants] ***[2 Marks]***

Q.7. **Significance of seed and fruit:**

i. Fruits provide nourishment to the developing seeds.
ii. Fruits protect the seeds in immature condition.
iii. Seeds serve as important propagating organs (units) of plant.
iv. Seeds and fruits develop special devices for their dispersal and thus help in the distribution of the species.

[2 Marks]

Q.8. i. In angiosperms, since embryo sac develops from a single megaspore, it is described as **monosporic development**.

ii. In angiosperms, the development of female gametophyte is **endosporous** i.e. within the megaspore.

Thus, development of female gametophyte in angiosperm is monosporic and endosporic.

[2 Marks]

SECTION C

Attempt any Two

Q.9. **Endospermic seeds:**

i. In some seeds, the food reserves in the endosperm are partially used up in the development of an embryo.

ii. Thus, in such seeds the endosperm remains conspicuous and fills a greater part of the seed.

iii. Such seeds are called endospermic or albuminous seeds.

iv. In endospermic seeds, cotyledons act as a first photosynthetic organs. (It means, on germination cotyledons forms first embryonic leaves of a seedling.)

[2 Marks]

v. e.g. Castor, Coconut, Maize, etc.

[Any two examples] ***[1 Mark]***

Q.10. **Parthenocarpy:**

i. The term Parthenocarpy was coined by Noll (1902).

ii. It is the condition in which fruit is developed without the process of fertilization.

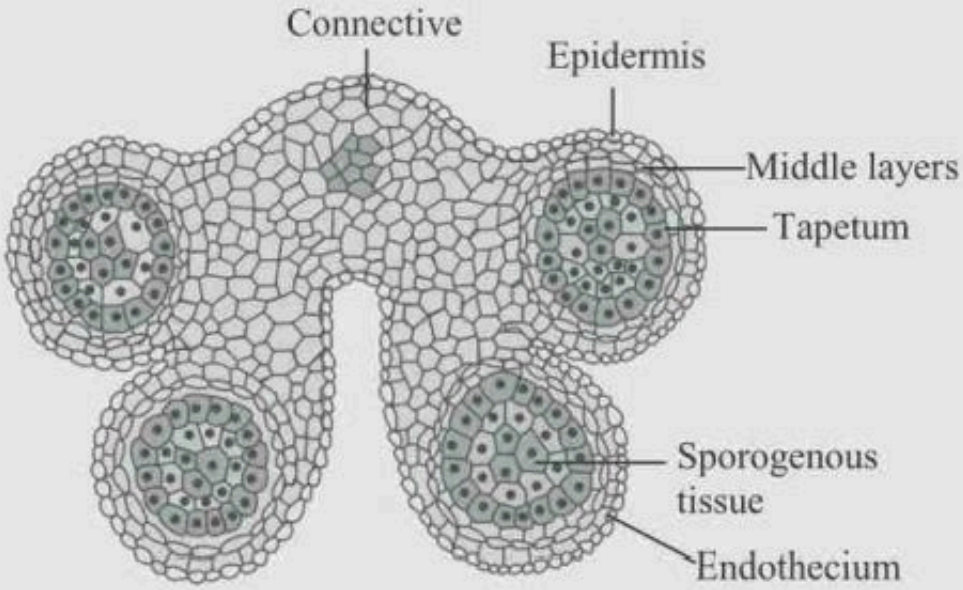
iii. It occurs naturally in some varities of Pineapple, Banana, Papaya, etc.

iv. In these plants, the placental tissue in the unfertilized ovary produces auxin IAA (Indole-3 Acetic Acid) which is responsible for enlargement of ovary into fruit.

v. Parthenocarpic fruit resembles the normally produced fruit but it is seedless.

[3 Marks]

Q.11.



T.S. of Anther

[3 Marks]

SECTION D

Attempt any One

Q.12. **Double fertilization:**

i. The fusion of one male gamete with egg and that of another male gamete with secondary nucleus is called as double fertilization.
It is the characteristic feature of angiosperms.
It was discovered by Nawaschin in the liliaceous plants like *Lilium* and *Fritillaria*.

ii. When pollen grain reaches the surface of the stigma, it germinates and forms a pollen tube.

iii. Pollen tube penetrates the stigma, style, ovary chamber and then enters ovule.

iv. The growth of pollen tube is guided by the chemicals secreted by the synergids.

v. Usually when pollen tube enters ovule through the micropyle, it is termed as **porogamy**.
But in some cases, it enters through chalaza which is known as **chalazogamy**. In some plants it enters by piercing the integuments which is called **mesogamy**.

vi. A pollen tube penetrates embryo sac of ovule through its micropylar end.

vii. The pollen tube carrying male gametes penetrates in one of the synergids.

viii. Watery contents of synergid are absorbed by pollen tube, due to which it ruptures and release the contents, including the two non-motile male gametes.

ix. As non motile male gametes are carried through hollow pollen tube, it is known as **siphonogamy** that ensures fertilization to take place.

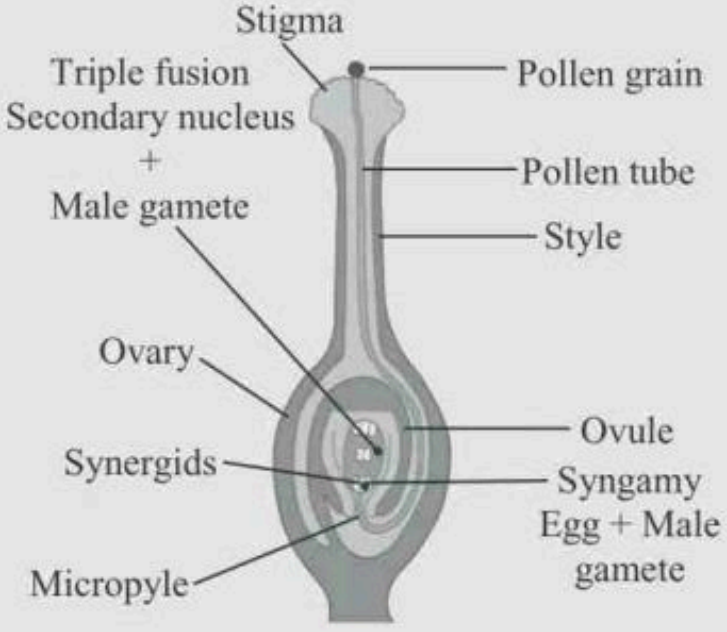
x. Fertilization mainly involves two processes: **Syngamy and Triple fusion**.

a. **Syngamy:**
It is the fusion of haploid male gamete with haploid female gamete (egg). It results in the formation of **diploid zygote** which develops to form **embryo**. Syngamy is a type of generative fertilization.

b. **Triple fusion:**
It is the fusion of second haploid male gamete with diploid secondary nucleus. It results in the formation of **Primary Endosperm Nucleus** (PEN) which develops into **triploid endosperm**. Triple fusion is a type of vegetative fertilization.

xi. In this process, both the male gametes participate, due to which fertilization occurs twice in the same embryo sac, hence it is described as **double fertilization**.

[4 Marks]



Double Fertilization

Q.13. Structure of an anatropous ovule:

i. Anatropous ovule is the most common type of ovule in angiosperms. It consists of following parts:

ii. **Funiculus / Stalk / Funicle:**
Each ovule develops inside the ovary. Ovule is attached to the placenta by a small stalk called funiculus.

iii. **Hilum:**
The point of attachment of funiculus to the main body of ovule is known as hilum.

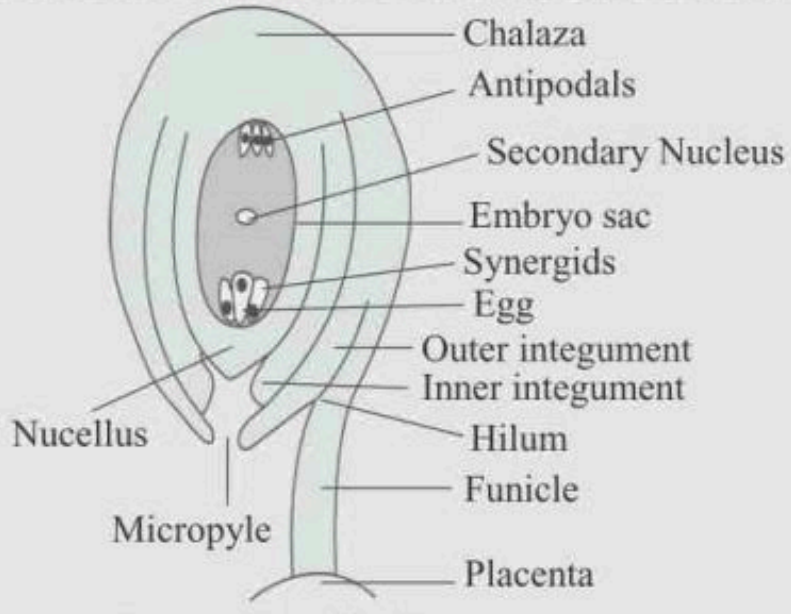
iv. **Nucellus:**
The ovule consists of central parenchymatous tissue called nucellus.

v. **Integuments:**
Nucellus is usually surrounded by two protective coverings called integuments viz. outer and inner integument.

vi. **Micropyle:**
A narrow opening at the apex of the ovule is called micropyle. It anatropous ovule, micropyle is directed downwards and is present adjacent to the funiculus (funicle).

vii. **Chalaza:**
Chalaza is the base of ovule directly opposite to micropyle.

viii. **Embryo sac:**
Embryo sac (female gametophyte) is oval multicellular structure embedded in the nucellus.



Anatropous Ovule

[4 Marks]

created by
Aman