SAMPLE CONTENT

Precise

BIOLOGY

Vol. I

BASED ON LATEST BOARD PAPER PATTERN

Std. XII Science

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Precise BIOLOGY (Vol. I)

Std. XII Sci.

Salient Features

- Written as per **Latest Board Paper Pattern**
- Subtopic-wise segregation for powerful concept building
- Complete coverage of Textual Exercise Questions and Intext Questions
- Marks provided to the Questions as per relevant weightage as deemed necessary
- Relevant Previous Years' Board Questions:
  - **March 2009 to July 2023**
- Each chapter contains:
  - 'Quick Review' of the chapter for quick revision
  - 'Exercise' to provide Theory questions and MCQs for practice
  - Selective questions from NCERT textbook for practice
- Includes Important Feature to elucidate concept: ***Reading Between the Lines***
- Q.R. codes provide:
  - The Video/PDF links boosting conceptual retention
- Includes Board Question Paper of March 2024 (Solution in PDF format through Q.R. code)

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PREFACE

Precise Biology Vol. I, Std. XII Sci. is intended for every Maharashtra State Board aspirant of Std. XII, Science. The scope, sequence, and level of the book are designed to match the latest textbook issued by Maharashtra State board.

With the examination in focus, the ***Precise Series*** has been specifically designed to make preparation easier, by providing a methodical and organized perspective of the curriculum, thus greatly improving the chances of scoring well.

Biological systems and their functions are the supreme complex chemical systems on Earth. We believe that the study of Biology helps in the understanding of many fascinating and important phenomena.

In order to make sure that students fully grasp the nub of the subject, it is important to present such concepts meaningfully and in an easy to read format.

In this vein, the Precise Biology book has been crafted to provide an **exam-centric approach** to the curriculum, while **retaining the essence** of the subject. Each chapter is thus structured to provide a **conceptual foundation**, in addition to offering **ample practice** for acing the board examination. We have put an effort to relate Biology to **real-world events** in order to show students that Biology is a vibrant, constantly evolving science that has relevance in our modern world.

We understand that Board Examinations can be daunting and the stress of cracking the examination can often leave students struggling to make sense of the curriculum. Relevant questions of Board Examination from **March 2009 to July 2023** are provided so that students would get an idea about the types of questions that are asked in Board Examinations.

A holistic preparation is the key to mastering any subject and conquering the board examination.

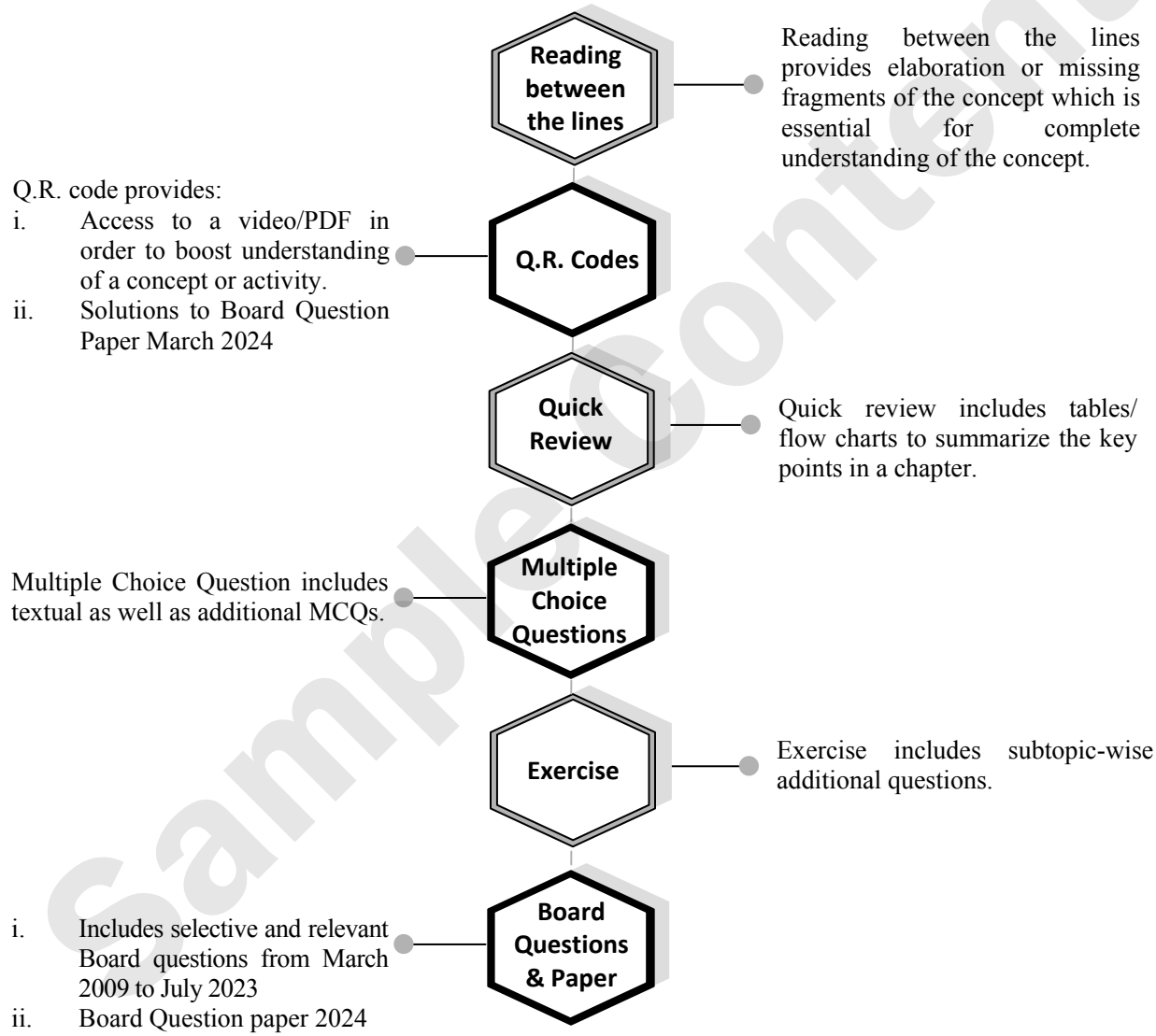
We hope this book becomes a valuable tool for you and helps you to understand the concepts of Biology.

Publisher

Edition: Sixth

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.
Please write to us on: mail@targetpublications.org

KEY FEATURES



PAPER PATTERN

- There will be one single theroy paper of 70 Marks and practical examination of 30 Marks in Biology.
- Duration of theory paper will be 3 hours.

Section A: **(18 Marks)**

This section will contain Multiple Choice Questions and Very Short Answer(VSA) type of questions.
There will be 10 MCQs and 8 VSA type of questions, each carrying **One** mark.
Students will have to attempt all the questions.

Section B: **(16 Marks)**

This section will contain 12 Short Answer (SA-I) type of questions, each carrying **Two** marks.
Students will have to attempt any 8 questions.

Section C: **(24 Marks)**

This section will contain 12 Short Answer (SA-II) type of questions, each carrying **Three** marks.
Students will have to attempt any 8 questions.

Section D: **(12 Marks)**

This section will contain 5 Long Answer (LA) type of questions, each carrying **Four** marks.
Students will have to attempt any 3 questions.

Distribution of Marks According to the Type of Questions

Type of Questions		
MCQ	1 Mark each	10 Marks
VSA	1 Mark each	8 Marks
SA - I	2 Marks each	16 Marks
SA - II	3 Marks each	24 Marks
LA	4 Marks each	12 Marks

CONTENTS

[Reference: Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04**]**

Note: 1. * mark represents Textual question.

2. 🔔 symbol represents textual questions that need external reference for an answer.

3. Questions from NCERT textbook are represented with tag [NCERT].

1 Reproduction in Lower and Higher Plants

Contents and Concepts

1.1 Asexual Reproduction

Q.1. Write a short note on asexual reproduction in lower organisms. **[3/4 Marks]**

Ans:

i. **Asexual reproduction:** It is a process of reproduction in which single parent is involved that results in production of morphologically and genetically identical progeny.

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 and *Protosiphon* (Algae). Under favourable conditions one or more outgrowths (buds) are formed on parent cell. These buds on separation from the parent body 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, Chlorella,* Diatoms *and Chlamydomonas*
- **e. Conidia formation:** It occurs in *Penicillium*
- **f. Gemmules formation:** It occurs in *Marchantia*.

Q.2. Identify the type of asexual reproduction given in the figures. **[2 Marks]**

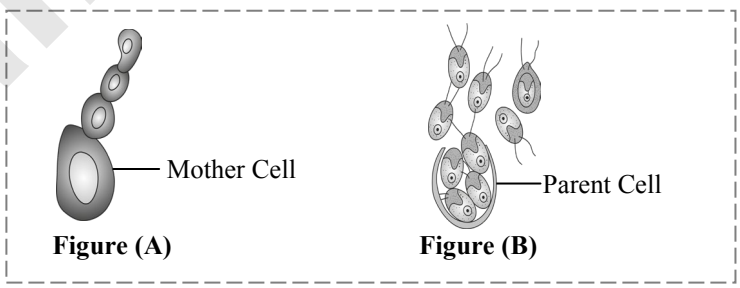


Figure (A) **Figure (B)**

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

Q.3.

i. What are the artificial methods of vegetative propagation? **[3 Marks]**

Ans: Artificial methods of vegetative propagation are as follows:

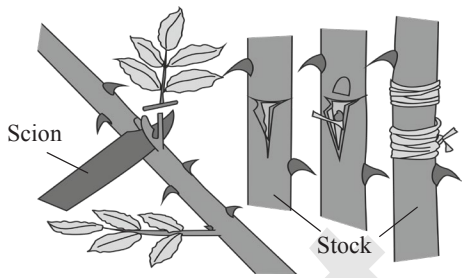
a. Cutting:

1. The small piece of any vegetative part of a plant having one or more buds is used for propagation.
2. Some of the common cuttings are:
   Stem cutting - e.g. Rose, *Bougainvillea*; leaf cutting - e.g. *Sansevieria*; root cutting e.g. Blackberry.

b. Grafting:

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

c. 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 *in vitro* on an artificial medium under aseptic conditions to get many plantlets. Micropropagation method is also used now a days.



Grafting in Rose

ii. What is vegetative reproduction? Describe any 'three' natural methods of vegetative reproduction with examples. **[Oct 14] [July 18]**

Ans: Vegetative propagation is a method of reproduction in which plants reproduce asexually through their vegetative parts. Natural methods of vegetative reproduction are as follows:

a. Roots: Sweet potato b. Leaf: Bryophyllum, c. Stem: Rhizome (Turmeric).

1.2 Sexual Reproduction

Q.4. Define flower and write its function. **[2 Marks]**

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.5. Name the four whorls of a typical flower. **[1 Mark]**

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

Q.6. Write a short note on sexual reproduction. **[3 Marks]**

Ans: Sexual reproduction:

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

ii. **Sequential events that occur in sexual reproduction** are grouped into three distinct stages viz. Pre-fertilization, Fertilization and the Post-fertilization.

iii. Pre-fertilization stage involves: gamete formation (meiosis).

iv. Fertilization is fusion of male and female gametes which results in formation of zygote and embryo (embryogenesis). Changes that happen after fertilization are grouped together into post-fertilization changes.

v. **Benefits:** Sexual reproduction leads to generation of variations, which are useful for the survival and the evolution of species.

Q.7. Explain in detail the structure of an anther. **[2/3 Marks]**

Ans: Structure of an anther:

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

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

iii. Each lobe of anther contains two pollen sacs.

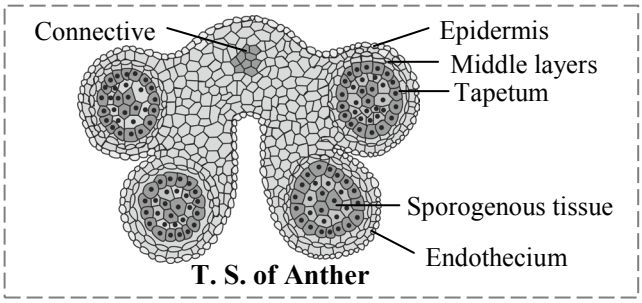
iv. In dithecous anther four pollen sacs are present, hence called as tetrasporangiate.

v. Each monothecous anther contains two pollen sacs (in family Malvaceae, anther is monothecous, bisporangiate)

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

Q.8. With the help of neat and labelled diagram explain the T.S. of anther. [4 Marks]

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.9. Name the layer which supplies nourishment to the developing pollen grains. [1 Mark]**
Ans: Tapetum supplies nourishment to the developing pollen grains.

1.3 Microsporogenesis

Q.10. What is microsporogenesis? [1 Mark] [Oct 13]
Ans: It is a process in which each microspore mother cell divides meiotically to form tetrad of haploid microspores (pollen grains).

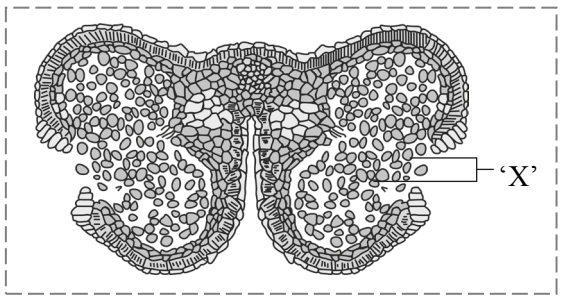
OR

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.11. Explain in detail the structure of microspore. [3 Marks]
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 these areas are 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.12. Find Out *(Textbook page no. 03)* **[1 Mark]**
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.13. Identify 'X' in the given figure and write a short note on its structure. **[3 Marks]**



Ans:

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

ii. For structure of pollen grain: *Refer Q.11.*

Q.14. Write a short note on pollen viability. **[2 Marks]**

Ans: Pollen viability:

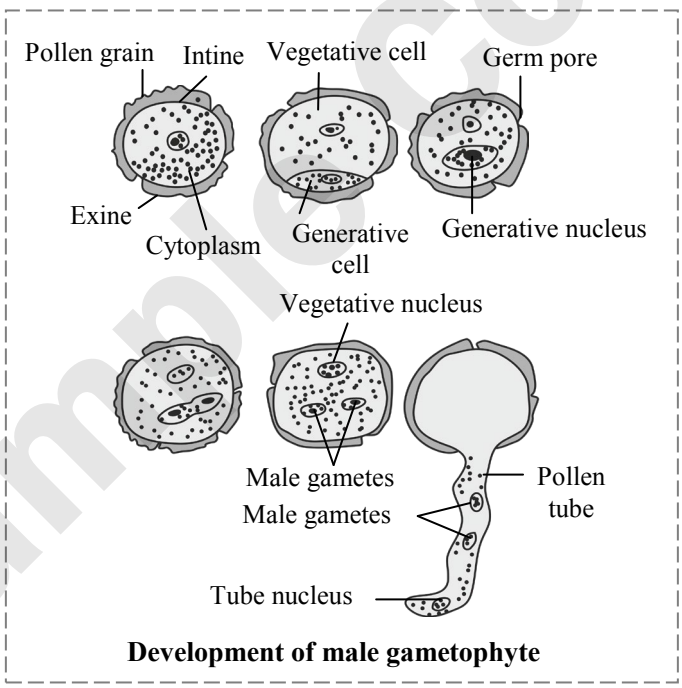
i. Pollen viability is the functional ability of pollen grain to germinate and develop male gametophyte.

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

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

***Q.15. Explain the stages involved in the maturation of microspore into male gametophyte.** **[4 Marks]**

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 have irregular shaped nucleus.

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

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

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

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

Reading between the lines

Development of male gametophyte
Before pollination in the pollen sac:
Refer Q.15 (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:

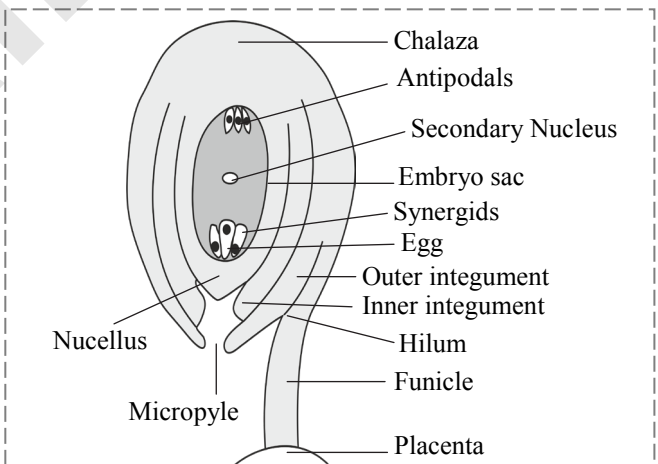
i. After pollination, the two-celled pollen grain gets deposited on the stigma and absorbs the sugary stigmatic secretion.
ii. Due to this, volume of cytoplasm increases, thus creating a pressure on the intine.
iii. The intine comes out in the form of a tube-like structure called pollen tube through 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.16. Arrange the following terms in a correct developmental sequence: Pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell, male gametes. [1 Mark] [NCERT]
Ans: Sporogenous tissue, pollen mother cell, microspore tetrad, pollen grain, male gametes.

1.4 Structure of Anatropus Ovule

Q.17. Name the following and give example wherever possible. [3 Marks]
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. Gynoecium (Pistil)
ii. Carpel (megasporophyll)
iii. Apocarpous (e.g. *Michelia*)
iv. Syncarpous (e.g. Brinjal)
v. Uniovulate (e.g. paddy, wheat and mango)
vi. Multiovulate (e.g. tomato and lady's finger)

Q.18. Draw neat and labelled diagram of anatropous ovule and explain its structure in detail. [4 Marks]
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. In 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.

1.5 Megasporogenesis

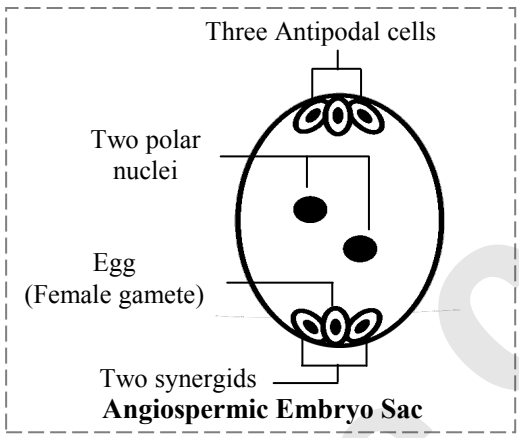
Q.19. Sketch and label angiospermic embryo sac. **[Mar 20]**

OR

Draw a neat diagram of angiospermic embryo sac and label the following parts

I. Female gamete II. Synergids III. Antipodal cells **[2 Marks]**

Ans:



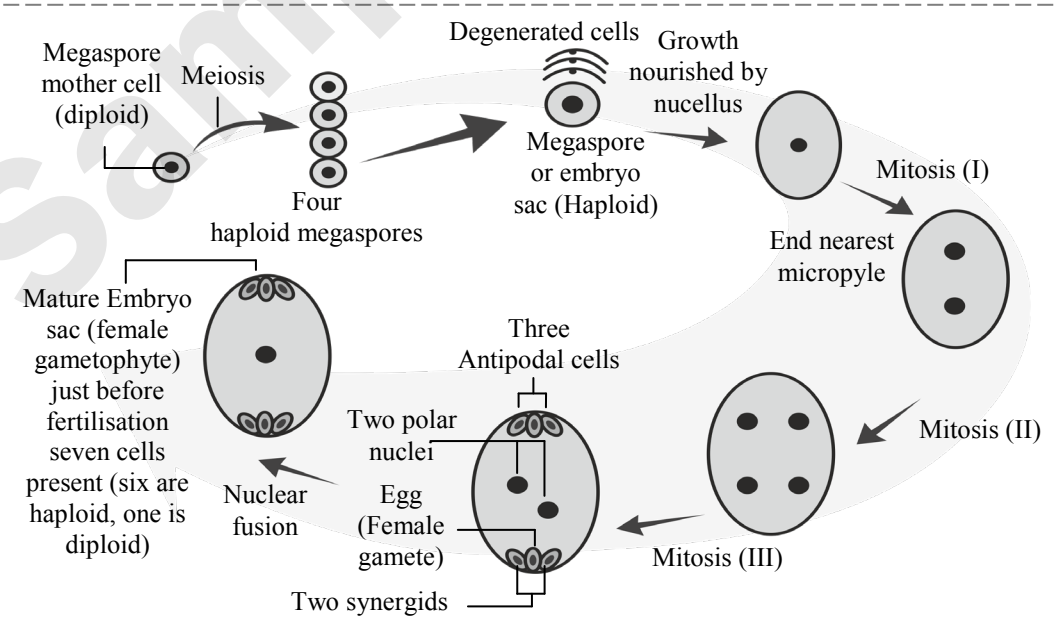
Angiospermic Embryo Sac

***Q.20. Define megasporogenesis.** **[1 Mark]**

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

Q.21. With the help of a neat and labelled diagram describe the development of female gametophyte of angiosperms. **[3 Marks] [Mar 18]**

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.22. How many haploid cells are present in a mature embryo sac? [1 Mark]**

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

***Q.23. What is the function of filiform apparatus? [1 Mark]**

Ans: Filiform apparatus guide the entry of pollen tube towards the egg.

1.6 Pollination

Q.24.
i. Define pollination.
ii. Enlist agents for pollination.
iii. Write how they are important to angiosperms. [3 Marks]

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.25. What are the two main types of pollination? [2/3 Marks]

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.26. Define the following terms: [1 Mark Each]
i. Chasmogamy
Ans: When flower opens to expose its sex organ, the condition is called as chasmogamy.

ii. Cleistogamy

Ans: 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

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

Q.27. Name the plants which exhibits both chasmogamous and cleistogamous flowers on the same plant. [1 Mark]

Ans: *Viola*, *Commelina benghalensis*.

Q.28. What is autogamy? [2 Marks]

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.29. Give reason: Geitonogamy is similar to autogamy but functionally it is cross pollination. [2/3 Marks]

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.30. What is Xenogamy? [2 Marks]

Ans: Xenogamy/ cross pollination/ out breeding:

i. It is a type of cross pollination when pollen grains of one flower are 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.31.

i. Define anemophily.

ii. Enlist the adaptations in anemophilous flowers. [3 Marks]

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 exerted with long filaments and versatile anthers.
e. Stamens and stigmas are exposed to air currents.

***Q.32. What is hydrophily? [1 Mark]**

Ans: Pollination carried out by water is called hydrophily.

Q.33. Describe any three adaptations in hydrophilous flowers. Mention any one example of the hydrophilous flower. [2 Marks] [Mar 23]

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.34. Explain two types of hydrophily in detail. [3 Marks]

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.35. Write a short note on entomophily. **[2/3 Marks]**

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 commonly occurs in Rose, Jasmine, *Cestrum*, *Salvia*, etc.

Q.36. Explain the term pollination syndromes. **[2/3 Marks]**

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.37. Add a note on pollination mechanism in *Salvia*. **[July 17]**

OR

Describe the given picture with respect to pollination. **[2 Marks]**

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.

Q.38. Write a short note on the type of pollination shown in the given picture. **[2/3 Marks]**

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.39. Define Chiropterophily and enlist the adaptations in chiropterophilous flowers. [2/3 Marks]

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

OR

Describe outbreeding devices which encourages cross pollination. [Mar 22]

OR

Explain any four contrivances to prevent self -pollination in plants with an appropriate example of each type. [4 Marks] [July 23]

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 are 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]***

1.8 Pollen-Pistil Interaction

Q.41. Explain in detail Pollen-Pistil interaction. [4 Marks]

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

OR

Name the part of gynoecium that determines the compatibility of pollen grains. [1Mark] [Mar 22]

Ans: Pistil (Surface of stigma**)** determines the compatible nature of pollen grain.

Q.43. Incompatibility is a natural barrier in the fusion of gametes. How will you explain this statement? [3/4Marks]

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.44. How pollen grains can be induced to germinate artificially? [2 Marks]

Ans:

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

Q.45. What is artificial hybridization? [2 Marks]

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.

1.9 Double Fertilization

Q.46. *Describe the process of double fertilization.

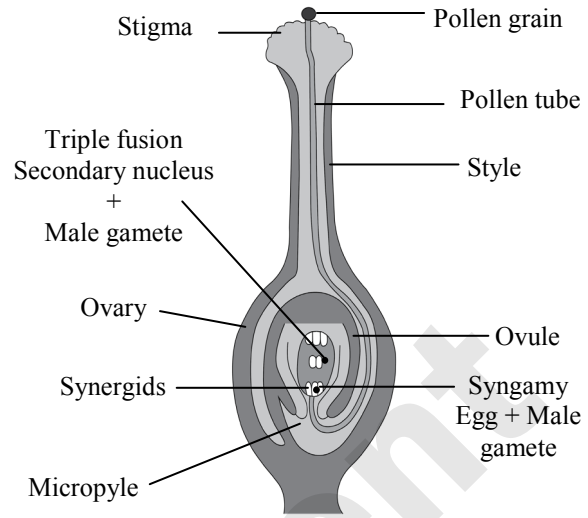
OR

What is double fertilization? Describe the process in brief. [4 Marks] [Mar 16]

Ans: 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.



Double Fertilization

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.**

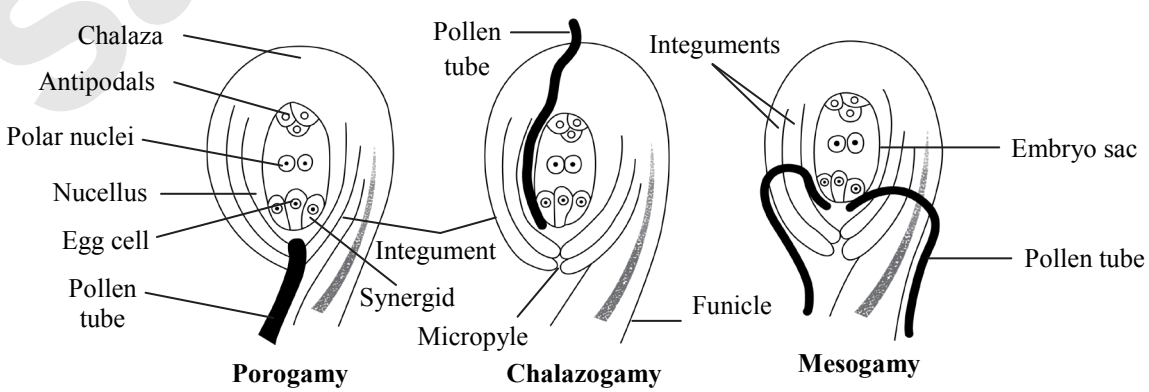
[Note: Scan the given Q. R. Code in *Quill - The Padhai App* to get information about **Double fertilization.]**

Q.47. If the megaspore mother cell has 26 chromosomes, what will be the total number of chromosomes in endosperm of the same plant? [1 Mark] [July 23]

Ans: The megaspore mother cell is a diploid cell, and the endosperm is a triploid tissue. If the megaspore mother cell has 26 chromosomes, the endosperm of the same plant will have 39 chromosomes.

Q.48. Draw neat and labelled diagrams of the types of entry of pollen tube into the ovule. [3/4 Marks]

Ans:



Entry of pollen tube into the ovule

Q.49. Write significance of double fertilization. **[2/3Marks]**

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 (2n) condition by fusion of haploid (n) male gamete with haploid (n) female gamete (i.e. through syngamy).
vi. It also helps to avoid polyembryony.

***Q.50. Even though each pollen grain has 2 male gametes, why atleast 20 pollen grains are required to fertilize 20 ovules in a particular carpel?** **[2 Marks]**

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.51. Draw a labelled diagram of the L.S. of anatropous ovule and list the components of embryo sac and mention their fate after fertilization.** **[4 Marks]**

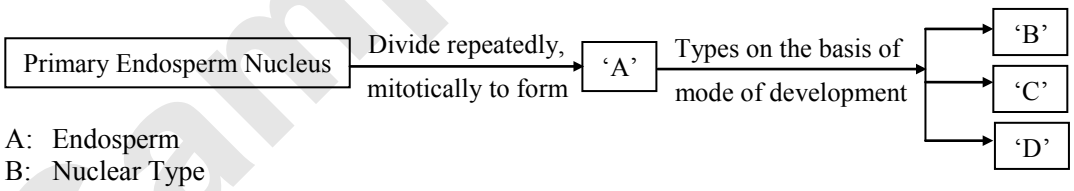
Ans:

i. For diagram of L.S. of anatropous ovule: *Refer Q.18*
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

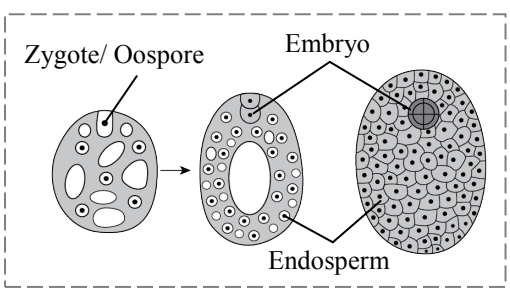
Q.52. Complete the given flow chart and explain each type with the help of neat and labelled diagram. **[4 Marks]**



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

i. Nuclear Type:

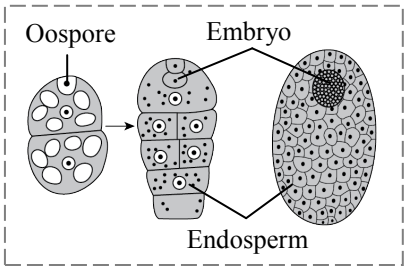
a. It is the most common type of endosperm found in 161 angiospermic families.
b. In this, the primary endosperm nucleus repeatedly divides mitotically without wall formation. Due to which large number of free nuclei are formed.
c. A big central vacuole appears in the centre of cell which pushes the 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.

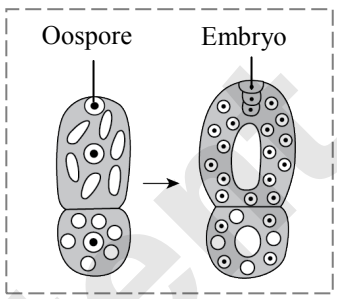
ii. Cellular Type:

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*.



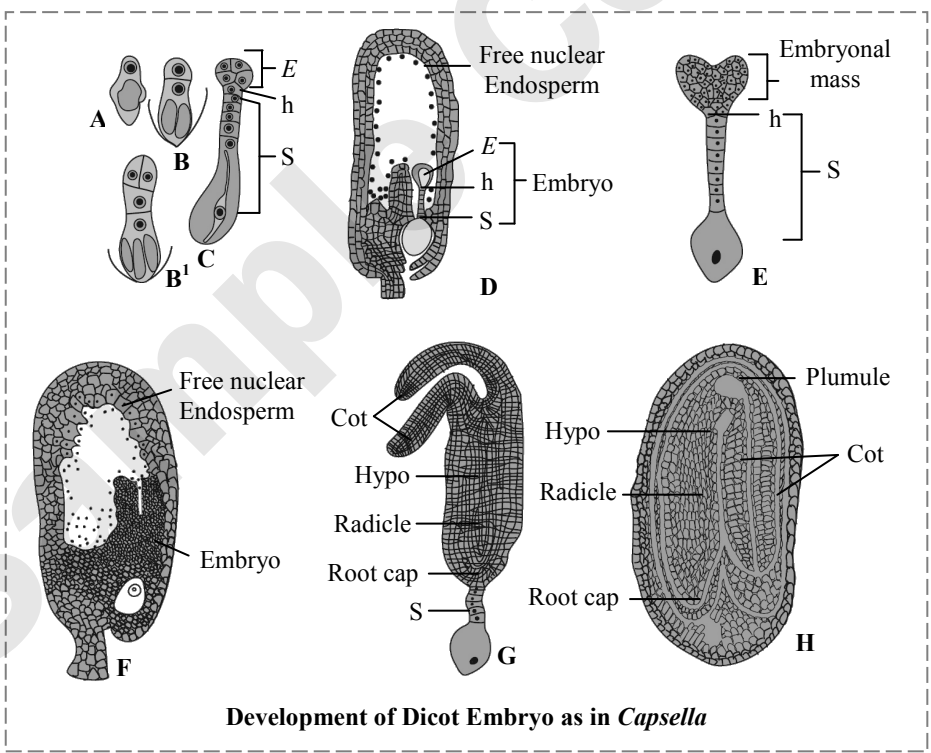
1.11 Development of Embryo

Q.53. Define embryogenesis. **[1 Mark]**

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

***Q.54. Explain the development of dicot embryo.** **[4 Marks]**

Ans:



Development of Dicot Embryo as in *Capsella*

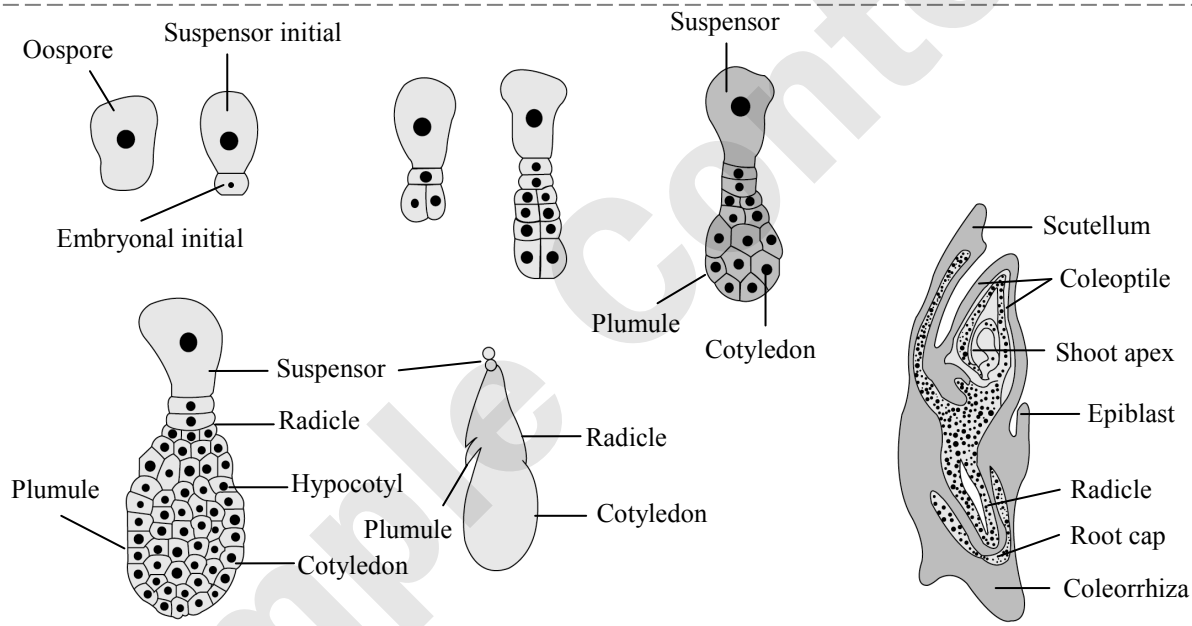
A: Oospore;
B: Two celled proembryo;
C: Further development of embryo;
D: L. S. of ovule;
E: Development of embryonic octants and hypophysis;
F: L. S. of ovule;
G: Embryo;
H: Mature seed;
B[1]: 4-celled I-shaped proembryo;
E: Embryonal mass.
Cot: Cotyledons;
Hypo: Hypocotyl;
S: Suspensor;
h: Hypophysis;
Embryo: Developing embryo

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.55. Draw the neat and labelled diagram of development of monocot (grass) embryo. [3 Marks]

Ans:



Development of Monocot (grass) Embryo

Q.56. Describe the structure of monocot embryo. [2 Marks]

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.57. Name the parts of pistil which develop into fruits and seeds. [1 Mark]**

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

1.12 Seed and Fruit Development

***Q.58. Pollination and seeds formation are very crucial for the fruit formation. Justify the statement. [2/3Marks]**

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 for fertilization.

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