

**SAMPLE CONTENT**



**PERFECT**

# **BIOLOGY** Vol. I

As per the new textbook prescribed  
by Maharashtra State Board

**Std. XII Sci.**

**Phenotypic variations:**

Phenotypic variations observed within populations may be caused due to genetic differences between individuals, or due to differences in environmental factors, or by interaction between genetics and the environmental factors.



**Target** Publications® Pvt. Ltd.

# PERFECT BIOLOGY (Vol. I) Std. XII Sci

## Salient Features

- ☞ Written as per the new textbook
- ☞ Subtopic-wise segregation for powerful concept building
- ☞ Complete coverage of Textual Exercise Questions and Intext Questions
- ☞ Extensive coverage of New Type of Questions
- ☞ 'Apply Your Knowledge' section to test application of concepts
- ☞ 'Quick Review' at the end of every chapter facilitates quick revision
- ☞ 'Competitive Corner' presents questions from prominent competitive examinations
- ☞ Reading Between the Lines, Enrich Your Knowledge, Gyan Guru, Connections, NCERT Corner are designed to impart holistic education
- ☞ Topic Test at the end of each chapter for self-assessment
- ☞ Video/ADF links provided via QR codes for boosting conceptual retention

Printed at: **Quarterfold Printabilities**, Navi Mumbai

© Target Publications Pvt. Ltd.

No part of this book may be reproduced or transmitted in any form or by any means, C.D. ROM/Audio Video Cassettes or electronic, mechanical including photocopying; recording or by any information storage and retrieval system without permission in writing from the Publisher.

## PREFACE

**Perfect Biology Std. XII, Vol. I** 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 new textbook issued by the Maharashtra State board.

At this crucial juncture in their lives, when the students are grappling with the pressures of cracking a career-defining board examination, we wanted to create a book that not only develops the necessary knowledge, tools, and skills required to excel in the examination, but also enables students to appreciate the beauty of the subject and piques their curiosity.

We believe that students respond favourably to meaningful content, if it is presented in a way that is easy to read and understand, rather than being mired down with facts and information. Consequently, we have always placed the highest priority on writing clear and lucid explanations of fundamental concepts. Moreover, special care has been taken to ensure that the topics are presented in a logical order. The Question/Answer approach helps students expand their horizon of understanding of the concepts.

The primary purpose of this book is to assist the students in preparing for the board examination. However, this is closely linked to other goals: to exemplify how important and how incredibly interesting Biology is, and to help the student become an expert thinker and problem solver.

The scope of the book extends beyond the State Board examination as it also offers a plethora of Multiple Choice Questions (MCQs) in order to familiarize the students with the pattern of competitive examinations.

In addition, the Topic-Test has been carefully crafted to focus on concepts, thus providing the students with a quick opportunity for self-assessment and giving them an increased appreciation of chapter-preparedness.

We believe that the study of Biology helps in the understanding of many fascinating and important phenomena. In this vein, 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 hope this book becomes a valuable tool for you and helps you to understand the concepts of Biology.

*Our Perfect Biology Std. XII, Vol. I adheres to our vision and achieves several goals: **building concepts, recapitulation, self-study, self-assessment and student engagement**-all while encouraging students towards cognitive thinking.*

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](mailto:mail@targetpublications.org)

*A book affects eternity; one can never tell where its influence stops.*

*Best of luck to all the aspirants!*

From,  
Publisher

**Edition:** First

### Disclaimer

This reference book is transformative work based on textbook Biology; First edition: 2020 published by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. We the publishers are making this reference book which constitutes as fair use of textual contents which are transformed by adding and elaborating, with a view to simplify the same to enable the students to understand, memorize and reproduce the same in examinations.

This work is purely inspired upon the course work as prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. Every care has been taken in the publication of this reference book by the Authors while creating the contents. The Authors and the Publishers shall not be responsible for any loss or damages caused to any person on account of errors or omissions which might have crept in or disagreement of any third party on the point of view expressed in the reference book.

© reserved with the Publisher for all the contents created by our Authors.

No copyright is claimed in the textual contents which are presented as part of fair dealing with a view to provide best supplementary study material for the benefit of students.

## FEATURES

### 1.1 Asexual Reproduction

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

**Ans:**

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

### Sub-topic wise Segregation

Every chapter is segregated sub-topic wise. A subtopic encompasses textual content in the format of Question-Answers, Textual Exercise questions, Intext questions, 'Can you tell', 'Can you recall', 'Think about this', 'Use your brain power' and 'Activity' are placed aptly amongst various additional questions in accordance with the flow of subtopic. This is our attempt to ensure easy assimilation of concepts and lay strong foundation for understanding as well as writing answers in exam.

### Reading between the lines

**Reading between the lines** provides elaboration or missing fragments of the concept which is essential for complete understanding of the concept.

*This is our attempt to the help students to understand the underlying concept behind an answer.*

### Reading between the lines



#### Positive feedback – Ovulatory phase

Positive feedback occurs at high concentration near the end of the follicular phase. High levels of estrogen from mature follicles exert a positive feedback mechanism on hypothalamus and anterior pituitary, thereby increasing the secretion of GnRH and LH. GnRH promotes release of FSH and more LH and LH surge causes ovulation.

### NCERT Corner

- Pleiotropy**

#### Sickle cell anaemia:

- This disease is caused by a mutation which substitutes the Glutamic acid (Glu) by Valine (Val) at the 6<sup>th</sup> position in the beta  $\beta$ -globin chain of the haemoglobin molecule.
- This is a result of a single base substitution from GAG to GUG at the sixth codon of  $\beta$ -globin gene.
- The substitution leads to formation of mutant haemoglobin. Mutant haemoglobin molecule undergoes polymerization under low oxygen tension which causes change in the shape of RBC.
- A normal RBC has a biconcave structure. In sickle cell anaemia sufferers, RBCs become elongated and obtain sickle shape.

### NCERT Corner

**NCERT Corner** covers information from NCERT textbook relevant to topic. This is our attempt to bridge the gap between NCERT curriculum and State Board textbook, thereby benefiting students in their preparation of National level competitive examinations.

## FEATURES

### Connections

**Connections** enable students to interlink concepts covered in different chapters. *This is our attempt to encourage students to appreciate the subject as a whole.*



### Connections

In chapter 7, you will study about **Dynamic equilibrium** and **Carrier hypothesis** theory in detail.

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



**QR code** provides access to a video/PDF in order to boost understanding of a concept or activity. *This is our attempt to facilitate learning through visual aids.*

### Enrich Your Knowledge

**Enrich Your Knowledge** presents fascinating information about the concept covered. *This is our attempt to create interest in the students about the concept.*

### Enrich Your Knowledge



The atmospheric  $\text{CO}_2$  is virtually the only source of carbon, which is the basic constituent of all the organic compounds.

### GG-Gyan Guru

#### COVID-19

*It is an infectious disease caused by a newly discovered coronavirus. Most of the people infected with the COVID-19 virus will experience mild to moderate respiratory illness but older people with medical problems like cardiovascular disease, diabetes, chronic respiratory disease and cancer are likely to develop serious illness. It spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, therefore it is important to practise respiratory etiquette.*

### GG-Gyan Guru

**Gyan Guru** illustrates real life applications or examples related to the concept discussed. *This is our attempt to link learning to the life.*

## FEATURES

### Apply Your Knowledge

**Q.100. Help the forensic analyst to solve the case.**

A blood specimen found at the crime scene does not belong to the victim. The forensic analyst suspects that it belongs to the murderer. The lab analyst extracted and amplified DNA from the blood sample.

- What would be the next step performed by forensic analyst?
- Which medium would be used by the analyst to separate DNA fragments by electrophoresis?

### Apply Your Knowledge

**Apply Your Knowledge** includes challenging questions.

*This is our attempt to take students one step further and challenge their conceptual understanding.*

### Quick Review

**Quick review** includes tables/ flow charts to summarize the key points in a chapter.

*This is our attempt to help students to reinforce key concepts.*

### Quick Review

#### Parturition

First Stage  
(Dilation)

Second Stage  
(Expulsion)

Third Stage  
(Placental)

Duration: Few hours      20 – 60 minutes      10 – 45 minutes

### Exercise

#### 3.1 Chromosomes and Mechanism of Inheritance

1. What do you mean by heredity?

**Ans:** Refer Q.2

2. Make a list of phenotypes that were studied by Mendel in pea plant.

**Ans:** Refer Q.3

3. Enlist the reasons for Mendel's success in his hybridisation experiments.

**Ans:** Refer Q.4

### Exercise

**Exercise** includes subtopic-wise additional questions and problems.

*This is our attempt to provide additional practice to students to gauge their preparation.*

## FEATURES

### Multiple Choice Questions

- Gemmule formation takes place in \_\_\_\_\_.  
(A) *Hydra* (B) *Spongilla*  
(C) *Planaria* (D) *Amoeba*
- Hydra* multiplies asexually by \_\_\_\_\_.  
(A) budding (B) gemmule formation  
(C) regeneration (D) both(A) and (B)

### Multiple Choice Questions

**Multiple Choice Question** includes textual as well as additional MCQs. This is our attempt to give students practice of MCQs and prepare them thoroughly for board examination.

### Competitive Corner

**Competitive Corner** presents latest questions from prominent [NEET (UG), NEET (Odisha), MHT CET] competitive exams based entirely on the syllabus covered in the chapter.

*This is our attempt to introduce student to MCQs asked in competitive exam.*

### Competitive Corner

- Xylem transports [NEET (UG) 2019]  
(A) Water, mineral salts and some organic nitrogen only  
(B) **Water, mineral salts, some organic nitrogen and hormones**  
(C) Water only  
(D) Water and mineral salts only

Time: 1 Hour 30 min

TOPIC TEST

Total Marks: 25

### SECTION A

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

Which of the following is a short day plant?

- (A) Spinach (B) Wheat  
(C) *Dahlia* (D) Sunflower

### Topic Test

**Topic Test** covers questions from the chapter for self-evaluation purpose. This is our attempt to provide the students with revision and help them assess their knowledge of chapter.

# CONTENTS

Chapter No.	Chapter Name	Page No.
1	Reproduction in Lower and Higher Plants	1
2	Reproduction in Lower and Higher Animals	36
3	Inheritance and Variation	78
4	Molecular Basis of Inheritance	111
5	Origin and Evolution of Life	164
6	Plant Water Relation	202
7	Plant Growth and Mineral Nutrition	231
8	Respiration and Circulation	266

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

- Note:**
- \* mark represents a textual question.
  - # mark represents a text question.
  - 🔗 symbol represents textual questions that need external reference for an answer.

# 1

## Reproduction in Lower and Higher Plants

### Contents and Concepts

- |  |                                 |
|--|---------------------------------|
| 1.0 Introduction                       | 1.8 Pollen-Pistil Interaction   |
| 1.1 Asexual Reproduction               | 1.9 Double Fertilization        |
| 1.2 Sexual Reproduction                | 1.10 Development of Endospore   |
| 1.3 Microsporogenesis                  | 1.11 Development of Embryo      |
| 1.4 Structure of Anther and Ovule      | 1.12 Seed and Fruit Development |
| 1.5 Megasporogenesis                   | 1.13 Apomixis                   |
| 1.6 Pollination                        | 1.14 Parthenocarpy              |
| 1.7 Outbreeding Devices (Contrivances) | 1.15 Polyembryony               |

### 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 that 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:

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

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*, *Paramecium*

**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**

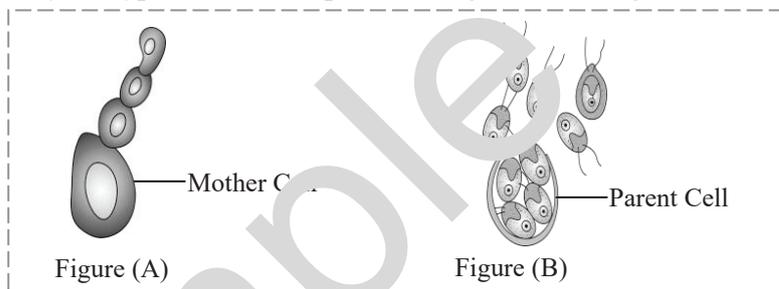
**i. Sporulation:**

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.**



**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. In 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

- It is a modification of root for vegetative reproduction.
- The underground roots in some plants store plenty of reserve food. Due to this, they become swollen.
- These roots develop adventitious buds on their surface which sprout under favourable conditions to produce leafy shoots and adventitious roots.
- Under suitable environmental conditions, these leafy shoots separate and develop into new plants.

**Vegetative propagation by stem:**

- Rhizome:** Small plantlets develop from rhizome of ginger.
- Tuber:** Small plantlets emerge from the eyes (buds) of potato tuber.
- 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:**

- In some plants like Bryophyllum, leaves take part in vegetative propagation.
- Adventitious buds called epiphyllous buds are developed on the leaves. These buds start sprouting on the leaf to form the plantlets.
- 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	Strawberry
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?**

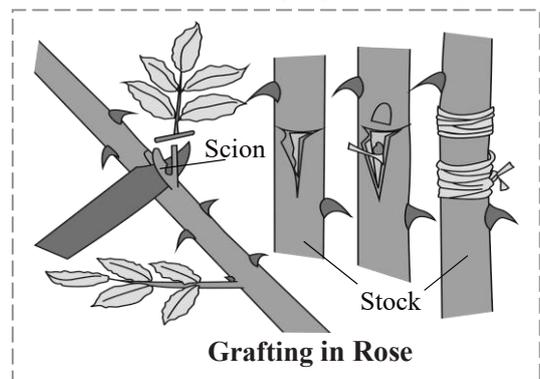
Ans: Artificial methods of vegetative propagation are as follows:

**i. Cutting:**

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

**ii. Grafting:**

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



**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:

- This is the characteristic feature of dicotyledonous plants which have cambium for secondary growth.
- As monocots do not have inter or intrafascicular cambium and do not show secondary growth, grafting is not possible in monocots.
- The success of grafting depends upon the match of cambium between stock and scion which results in organic connection between them.
- 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:

- It is more rapid, easier and cheaper method of propagation of plants compared to propagation by seeds.
- It is possible to obtain clones as plants produced will have same characters as that of parent plants.
- 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.
- By the methods like grafting desired character of the stock (e.g. disease resistance, vigour, etc.) can be transferred to the scion.
- 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.
- It is easy to get rid of pathogens from any part of the plant by vegetative propagation.
- It helps in the production of clones of economically useful and rare plants.

### 1.2 Sexual Reproduction

#### NCERT Corner

- 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.
- 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:
  - Bamboo species flower only once in their lifetime, generally after 50 – 100 years, produce numerous fruits and die.
  - Strobilanthes kunthiana* (Neelakuranji) flowers once in 12 years.

#### Q.11. Define flower and write its function.

**Ans:**

- 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

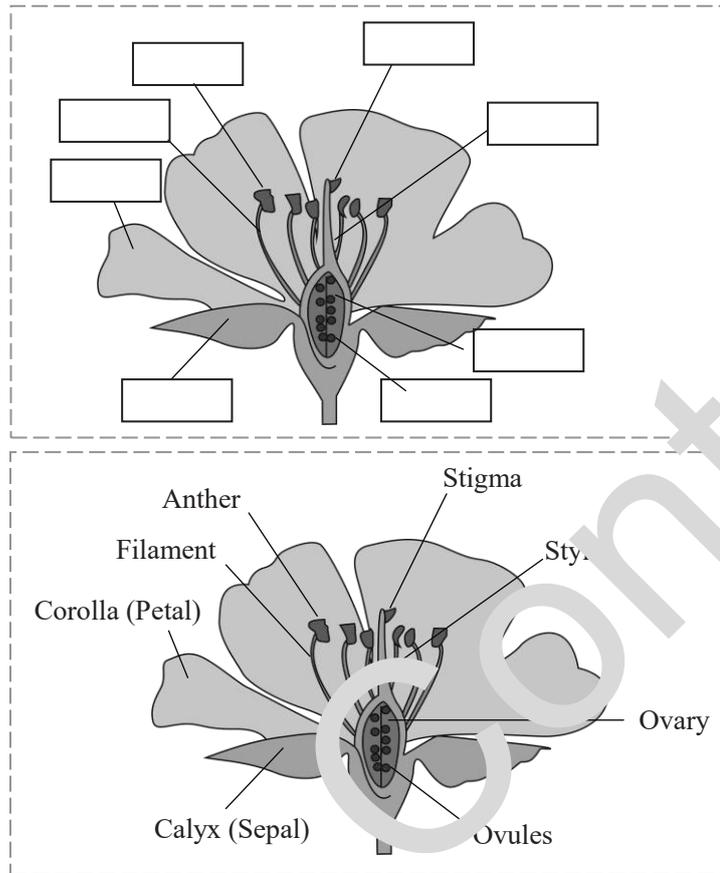
Flower is a condensed and modified shoot, specialized for sexual reproduction.

- 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.**

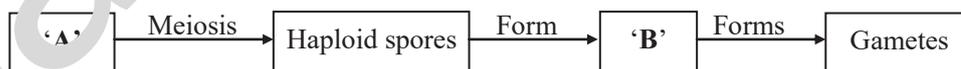
**Ans:** A typical flower consists of Calyx, Corolla, Androecium and Gynoecium.

**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

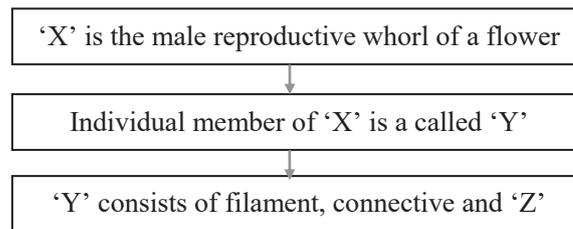
**Enrich Your Knowledge**



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

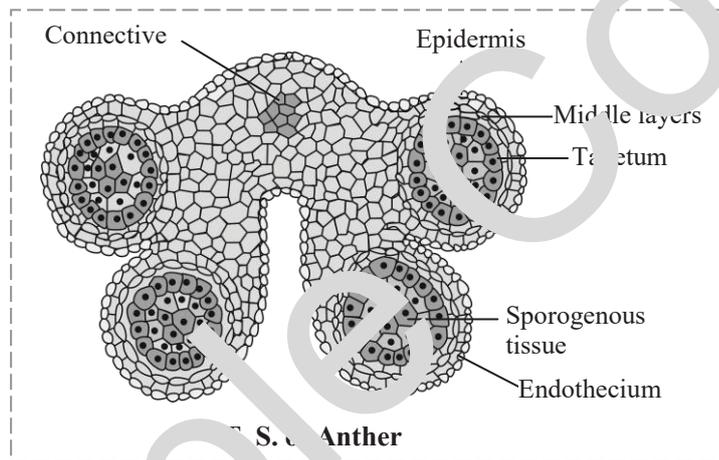
**Q.17. Explain in detail the structure of an anther.**

**Ans: Structure of an anther:**

- Anther is upper sac-like fertile part of the stamen.
- An immature stage of anther is represented by group of parenchymatous tissue surrounded by single layered epidermis.
- Anther consists of two anther lobes (dithecous), sometimes anther consists of one lobe (monothealous).
- In dithecous anther four pollen sacs are present, hence called as tetrasporangiate.
- Each monothealous anther contains of two pollen sacs.

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

**Ans:**



- Sporogenous tissue:**  
 Some hypodermal cells get transformed into archesporial cells.  
 The archesporial cell divides to form 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**.
- 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.

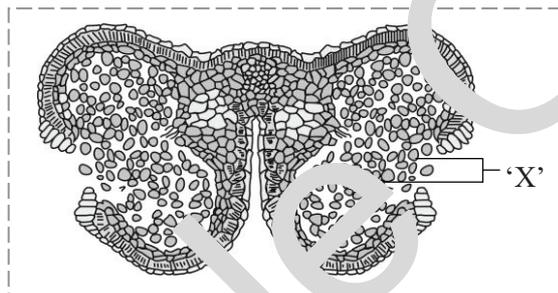
**Q.22. Find Out** (Textbook page no. 03)

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 temperature, 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. *Parrot grass* (*Parrot grass*) causes pollen allergy.

#### Useful 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, Leguminosae, Solanaceae, they remain viable for months.

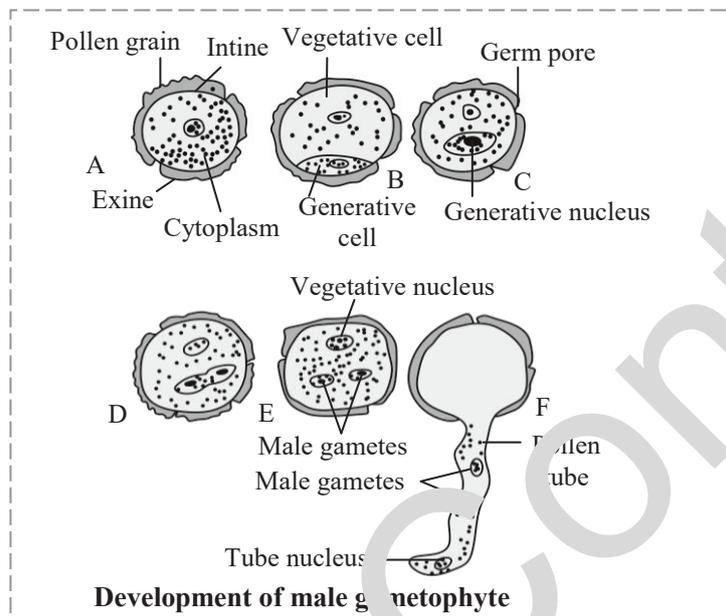


**NCERT Corner**

Pollen grains of a large number of species can be stored in liquid nitrogen ( $-196\text{ }^{\circ}\text{C}$ ) 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:**



- 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 larger, naked **vegetative cell** and small, thin walled **generative cell**.
- iii. The vegetative cell is rich in food and having a regular 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-v)

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 substance 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. 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.

Page no. **9** to **27** are purposely left blank.

To see complete chapter buy **Target Notes** or **Target E-Notes**



\*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

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

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.

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

**Practical / Project**

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

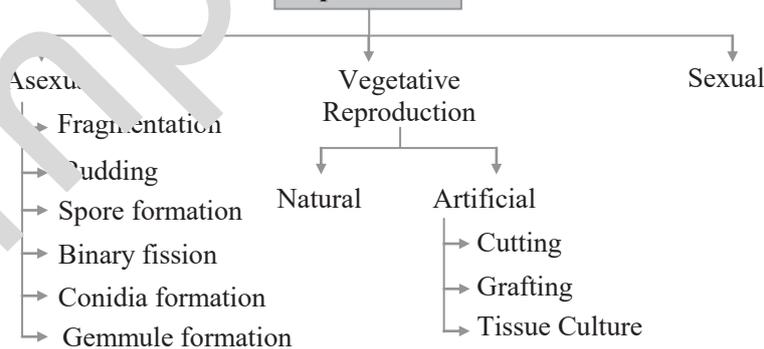
**Ans: Vegetative propagation by Leaf:**

- 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.

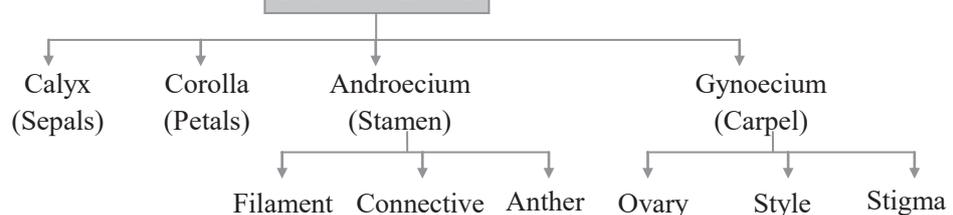
*[Note: Students are expected to collect more information about Natural vegetative propagation by leaves only in different vascular plants.]*

**Quick Review**

**Reproduction**

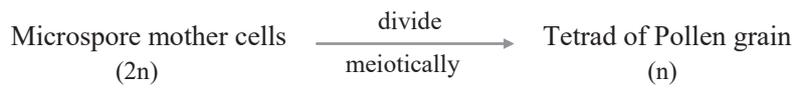


**Parts of a flower**

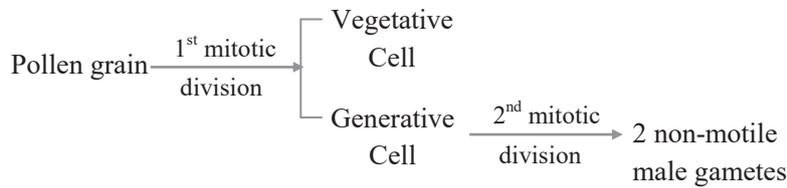




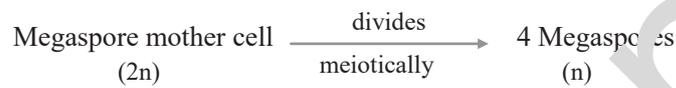
**Microsporogenesis**



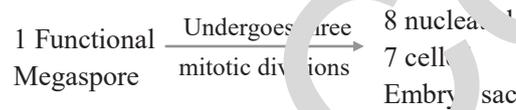
**Development of male gamete**



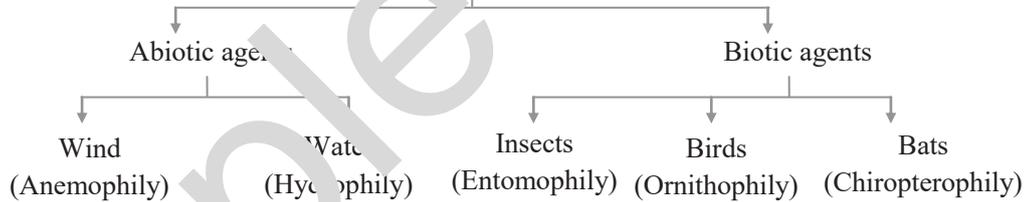
**Megasporogenesis**



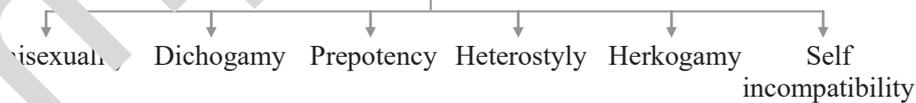
**Development of female gametophyte**



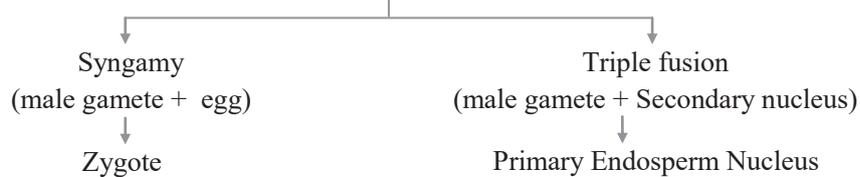
**Pollination**



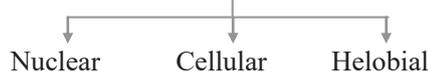
**Outbreeding Devices**



**Double fertilization**



**Types of endosperm**





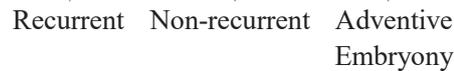
**Types of Seeds**



**Apomixis**

Formation of embryo(s) through asexual method of reproduction

Categories



**Parthenocarpy**

Fruits develop without fertilization

**Polyembryony**

Development of more than one embryo in seed

**Exercise**

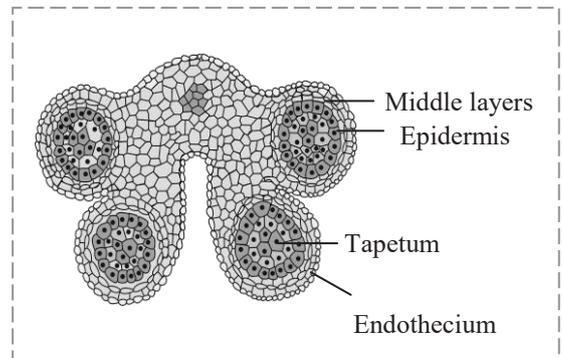
**1.1 Asexual Reproduction**

- What are the two methods of reproduction?  
**Ans:** Refer Q.2.(ii)
- Describe the methods of asexual reproduction in lower organisms.  
**Ans:** Refer Q.4.(ii)
- Explain the advantages of asexual reproduction in horticulture.  
**Ans:** Refer Q.3
- How do plants reproduce asexually?  
**Ans:** Refer Q.4.(ii-b) and Q.5 (A) Figure
- Explain the artificial methods of vegetative propagation.  
**Ans:** Refer Q.9.

**1.2 Sexual Reproduction**

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

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



- Ans:** Refer Q.18.
- What is tetrasporangiate anther?  
**Ans:** Refer Q.17.(iv)
  - Write a short note on anther wall.  
**Ans:** Refer Q.18.(ii)
  - What is the role of tapetum?  
**Ans:** Refer Q.19.
- 1.3 Microsporogenesis**
- 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?

**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 autogamy?

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

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

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

23. Write a short note on epihydrophyly.

**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

- Chlamydomonas* reproduce asexually by  
(A) binary fission  
(B) spore formation  
(C) budding  
(D) gemmule formation
- 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
- All the given below are parts of stamen, except  
(A) filament (B) style  
(C) connective (D) anther
- A ditheous anther is  
(A) unisporangiate (B) trisporangiate  
(C) bisporangiate (D) tetrasporangiate
- \_\_\_\_\_ layer of anther wall immediately encloses the sporogenous tissue.  
(A) middle (B) tapetum  
(C) endothecium (D) epidermis
- The exine of an anther is made up of complex, non-biodegradable substance called  
(A) tapetum (B) sporopollenin  
(C) pectin (D) cellulose
- A typical carpel has three parts viz. ovary, style and \_\_\_\_\_  
(A) vegetative cell (B) micropyle  
(C) stigma (D) chalazal
- \*8. In ovule, meiosis occurs  
(A) integument  
(B) nucellus  
(C) megasporangium  
(D) megasporocyte
9. Synergids show hair like projections called  
(A) apical (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 net or glass  
(D) Feathery stigma
16. Which of the following aquatic plant is anemophilous?  
(A) *Potamogeton* (B) Lotus  
(C) *Vallisneria spiralis* (D) Water lily
- \*17. Insect pollinated flowers usually possess  
(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 of 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) **parthenocarp**

6. Persistent nucellus in a seed is known as:

[NEET (UG) 2019]

- (A) Hilum (B) Tegmen  
 (C) Chalazium (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  $\xrightarrow{3 \text{ degenerate}}$  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:

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

Q.2. Answer the following

- 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 epispemic 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.

Download the answers of the Topic Test by scanning the given Q.R. Code.

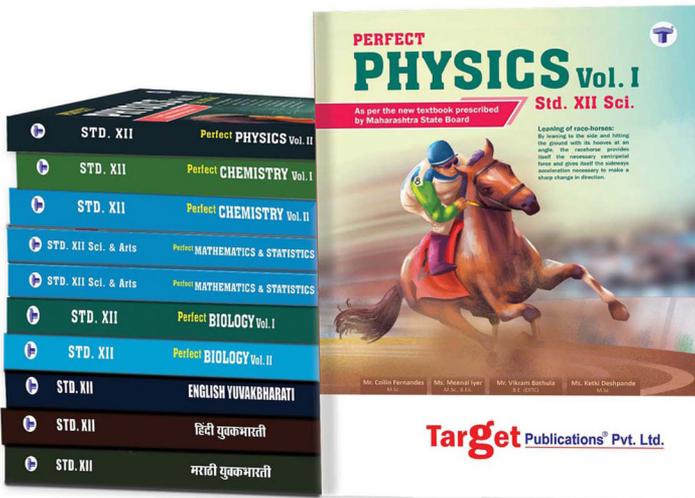




# Std. XII

## Perfect Science

For students who want to excel in board exams and simultaneously study for entrance exams



### Available Subjects:

- Perfect Physics Vol. I
- Perfect Physics Vol. II
- Perfect Chemistry Vol. I
- Perfect Chemistry Vol. II
- Perfect Mathematics & Statistics Part - I
- Perfect Mathematics & Statistics Part - II
- Perfect Biology Vol. I
- Perfect Biology Vol. II
- English Yuvakbharati
- Hindi Yuvakbharati
- Marathi Yuvakbharati

### Salient Features

**BUY NOW**

- Sub-topic wise segregation for powerful concept building
- Complete coverage of textual exercise questions, intext questions and numericals
- Extensive coverage of new type of questions
- NCERT Corner, Gyan Guru, Reading between the lines, Smart Check, Smart Recap are designed to impact holistic education
- Competitive Corner presents questions from prominent competitive examinations

**Target** Publications® Pvt. Ltd.

88799 39712 / 13 / 14 / 15

mail@targetpublications.org

www.targetpublications.org