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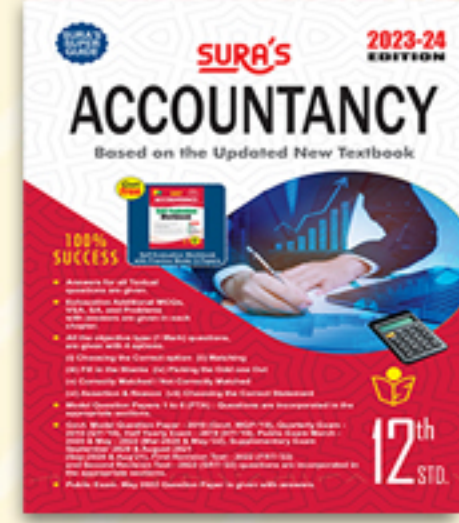
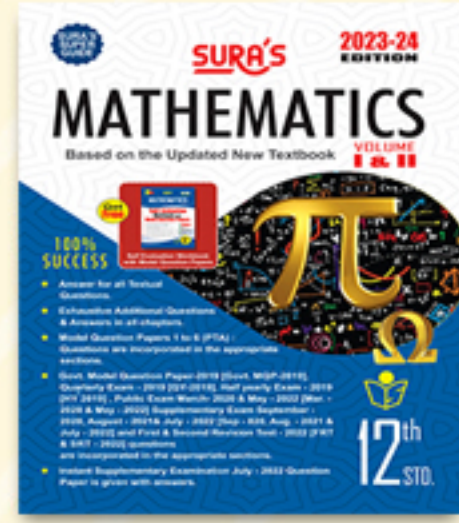
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# Preface

“ I am convinced that it will not be long before the whole world acknowledges the results of my work. To live without experiencing some shame and blushes of admiration would surely be a wretched life. ”

— Gregor Mendel —

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From the bottom of our heart, we at SURA Publications sincerely thank you for the support and patronage that you have extended to us for more than a decade.

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With due respect to Teachers, I would like to mention that our guide will serve as a teaching companion to qualified teachers. Also, this guide will be an excellent learning companion to students with exhaustive exercises and in-text questions in addition to precise answers for textual questions.

In complete cognizance of the dedicated role of Teachers, I completely believe that our students will learn the subject effectively with this guide and prove their excellence in Board Examinations.

I once again sincerely thank the Teachers, Parents and Students for supporting and valuing our efforts.

God Bless all.

**Subash Raj, B.E., M.S.**

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## UNIT VI : Reproduction in Plants

### Chapter

# 1

# ASEXUAL AND SEXUAL REPRODUCTION IN PLANTS

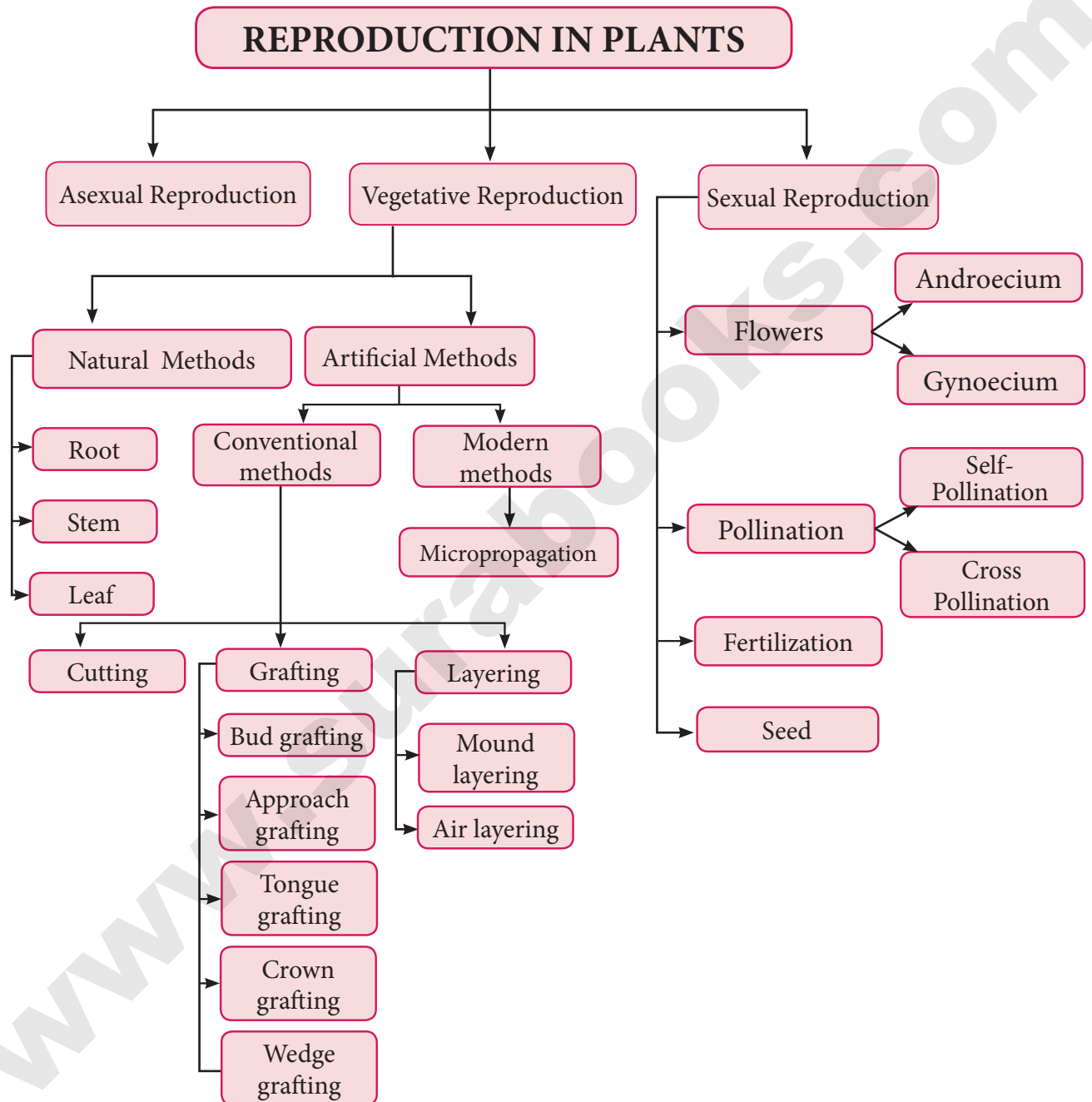
### *Chapter Snapshot*

- 1.1 Asexual Reproduction
- 1.2 Vegetative Reproduction
  - 1.2.1 Natural methods
  - 1.2.2 Artificial Methods
- 1.3 Sexual Reproduction
- 1.4 Pre-fertilization: Structures and Events
  - 1.4.1 Male Reproductive part - Androecium
  - 1.4.2 Female reproductive part - Gynoecium
  - 1.4.3 Pollination
- 1.5 Fertilization
  - 1.5.1 Double fertilization and triple fusion
- 1.6 Post Fertilization: Structure and Events
- 1.7 Apomixis
- 1.8 Polyembryony
- 1.9 Parthenocarpy





## Concept Map







## MUST KNOW DEFINITIONS

<b>Polyembryony</b>	:	Occurrence of more than one embryo in a seed.
<b>Amphimixis</b>	:	Method of reproduction which involves fertilization.
<b>Apomixis</b>	:	Method of reproduction which does not involve fertilization.
<b>Endosperm</b>	:	A triploid nutritive tissue that nourishes the developing embryo.
<b>Microsporogenesis</b>	:	Stages involved in formation of haploid microspores from diploid microspore mother cells.
<b>Embryo sac</b>	:	Oval sac-like structure found in the nucellus of the ovule and acts as female gametophyte.
<b>Megasporogenesis</b>	:	The process of development of a megaspore from a megaspore mother cell.
<b>Pollination</b>	:	Transfer of pollen from anther to stigma.
<b>Self pollination</b>	:	Transfer of pollen from anther to stigma of the same flower.
<b>Cross pollination</b>	:	Transfer of pollen from anther of a flower to the stigma of another flower on the same plant or different plant of the same species.
<b>Double fertilization</b>	:	Fusion of one Female Gametes to two Male Gametes.
<b>Triple fusion</b>	:	Fusion of sperm with diploid secondary nucleus to form triploid endosperm nucleus.
<b>Radicle</b>	:	Embryonic root is called radicle.
<b>Plumule</b>	:	Embryonic shoot is called plumule.
<b>Apospory</b>	:	The process of embryo sac formation from diploid cells of nucellus as a result of mitosis.
<b>Budding</b>	:	A method of asexual reproduction where small outgrowth (Bud) from a parent cell are produced.
<b>Callus</b>	:	Undifferentiated mass of cells obtained through tissue culture.
<b>Clone</b>	:	Genetically identical individuals.
<b>Endothecium</b>	:	A single layer of hygroscopic, radially elongated cells found below the epidermis of anther which helps in dehiscence of anther.
<b>Fertilization</b>	:	The act of fusion of male and female gamete
<b>Grafting</b>	:	Conventional method of reproduction where stock and scion are joined to produce new plant.





<b>Horticulture</b>	:	Branch of plant science that deals with the art of growing fruits, vegetables, flowers and ornamental plants.
<b>Nucellus</b>	:	The diploid tissue found on the inner part of ovule next to the integuments.
<b>Pollenkitt</b>	:	A sticky covering found on the surface of the pollen that helps to attract insects.
<b>Regeneration</b>	:	Ability of organisms to replace or restore the lost parts.
<b>Sporopollenin</b>	:	Pollen wall material derived from carotenoids and is resistant to physical and biological decomposition.
<b>Tapetum</b>	:	Nutritive tissue for the developing sporogenous tissue.
<b>Transmitting tissue</b>	:	A single layer of glandular canal cells lining the inner part of style.

## TERMINOLOGIES & EXAMPLES

<b>Conidia</b>	:	<i>Aspergillus</i> and <i>Penicillium</i>
<b>Budding</b>	:	<i>Yeast</i> and <i>Hydrilla</i>
<b>Fragmentation</b>	:	<i>Spirogyra</i>
<b>Gemma</b>	:	<i>Marchantia</i>
<b>Regeneration</b>	:	<i>Planaria</i>
<b>Binary Fission</b>	:	<i>Bacteria</i>
<b>Buds in Roots</b>	:	<i>Murraya</i> , <i>Dalbergia</i> and <i>Millingtonia</i>
<b>Tuberous Roots</b>	:	<i>Ipomoea batatas</i> and <i>Dahlia</i>
<b>Rhizome</b>	:	<i>Musa paradisiaca</i> , <i>Zingiber officinale</i> and <i>curcuma longa</i>
<b>Corm</b>	:	<i>Amorphophallus</i> and <i>Colocasia</i>
<b>Tuber</b>	:	<i>Solanum tuberosum</i>
<b>Bulb</b>	:	<i>Allium cepa</i> and <i>Lilium</i>
<b>Runner</b>	:	<i>Centella asiatica</i>

<b>Stolon</b>	:	<i>Mentha</i> and <i>Fragaria</i>
<b>Offset</b>	:	<i>Pistia</i> and <i>Eicchornia</i>
<b>Sucker</b>	:	<i>Chrysanthemum</i>
<b>Bulbil</b>	:	<i>Dioscorea</i> and <i>Agave</i>
<b>Epiphyllous Bud</b>	:	<i>Bryophyllum</i>
<b>Root Cutting</b>	:	<i>Malus</i>
<b>Stem Cutting</b>	:	<i>Hibiscus</i> , <i>Bougainvillea</i> and <i>Moringa</i>
<b>Leaf Cutting</b>	:	<i>Begonia</i> and <i>Bryophyllum</i>
<b>Grafting</b>	:	Citrus, Mango, Apple
<b>Layering</b>	:	<i>Ixora</i> and <i>Jasminum</i>
<b>Pollinium</b>	:	<i>Calotropis</i>
<b>Compound Pollen grain</b>	:	<i>Drosera</i> and <i>Drymis</i>
<b>Pollen-10 micrometer</b>	:	<i>Myosotis</i>
<b>Pollen-200 micrometer</b>	:	Cucurbitaceae and Nyctaginaceae





<b>Orthotropous Ovule</b>	: Piperaceae and Polygonaceae
<b>Anatropous Ovule</b>	: Dicot and Monocot
<b>Hemianatropous Ovule</b>	: Primulaceae
<b>Campylotropous Ovule</b>	: Leguminosae
<b>Amphitropous Ovule</b>	: Alismataceae
<b>Circinotropous Ovule</b>	: Cactaceae
<b>Monosporic megaspore</b>	: <i>Polygonum</i>
<b>Bisporic Megaspore</b>	: <i>Allium</i>
<b>Tetrasporic Megaspore</b>	: <i>Peperomia</i>
<b>Cleistogamous flowers</b>	: <i>Commelina</i> , <i>Viola</i> and <i>Oxalis</i>
<b>Homogamy</b>	: <i>Mirabilis jalapa</i> , <i>Catharanthus roseus</i>
<b>Monoecious flower</b>	: Coconut and Bitter gourd
<b>Dioecious flower</b>	: <i>Borassus</i> and <i>Carica papaya</i>
<b>Protandry</b>	: <i>Helianthus</i> and <i>Clerodendrum</i>
<b>Protogyny</b>	: <i>Scrophularia nodosa</i> and <i>Aristolochia bracteata</i>
<b>Distyly</b>	: <i>Primula</i>
<b>Tristyly</b>	: <i>Lythrum</i>
<b>Self sterility</b>	: <i>Abutilon</i> and <i>Passiflora</i>
<b>Anemophily</b>	: Grasses, Sugarcane, Bamboo, Coconut, Palm and Maize
<b>Hydrophily</b>	: <i>Vallisneria</i> and <i>Hydrilla</i>

<b>Epihydrophily</b>	: <i>Vallisneria spiralis</i> and <i>Elodea</i>
<b>Hypohydrophily</b>	: <i>Zostera marina</i> , <i>Ceratophyllum</i>
<b>Ornithophily</b>	: <i>Erythrina</i> , <i>Bombax</i> , <i>Syzygium</i> , <i>Bignonia</i> and <i>Strelitzia</i>
<b>Perianth (Fleshy and Edible)</b>	: Jack fruit
<b>Funiculus - fleshy structure</b>	: <i>Myristica</i> and <i>Pithecellobium</i>
<b>Nuclear Endosperm</b>	: <i>Coccinia</i> , <i>Capsella</i> and <i>Arachis</i>
<b>Cellular Endosperm</b>	: <i>Adoxa</i> , <i>Helianthus</i> and <i>Scoparia</i>
<b>Helobial Endosperm</b>	: <i>Hydrilla</i> and <i>Vallisneria</i>
<b>Ruminate Endosperm</b>	: <i>Myristica</i>
<b>Endospermous Seed</b>	: Wheat, Maize, Barley and Sunflower
<b>Non-Endospermous Seed</b>	: Bean, Mango, and Cucurbits.
<b>Bulbil</b>	: <i>Fritillaria imperialis</i>
<b>Adventive Embryony</b>	: <i>Citrus</i> and <i>Mangifera</i>
<b>Diplospory</b>	: <i>Eupatorium</i> and <i>Aerva</i>
<b>Apospory</b>	: <i>Hieracium</i> and <i>Parthenium</i>
<b>Parthenocarpic fruits</b>	: Banana, Grapes and Papaya
<b>Genetic parthenocarpy</b>	: <i>Citrus</i> and <i>cucurbita</i>
<b>Environmental parthenocarpy</b>	: Pear



## EVALUATION

1. Choose the correct statement from the following.

- (a) Gametes are involved in asexual reproduction.
- (b) Bacteria reproduce asexually by budding.
- (c) Conidia formation is a method of sexual reproduction.
- (d) Yeast reproduce by budding.

[Ans. (d) Yeast reproduce by budding]

2. An eminent Indian embryologist is

- (a) S.R. Kashyap
- (b) P. Maheswari
- (c) M. S. Swaminathan
- (d) K. C. Mehta

[Ans. (b) P. Maheshwari]

3. Identify the correctly matched pair [FRT-'22]

- (a) Tuber – *Allium cepa*
- (b) Sucker – *Pistia*
- (c) Rhizome – *Musa*
- (d) Stolon – *Zingiber*

[Ans. (c) Rhizome - *Musa*]

4. Pollen tube was discovered by

- (a) J. G. Kolreuter
- (b) G. B. Amici
- (c) E. Strasburger
- (d) E. Hanning

[Ans. (b) G. B. Amici]

5. Size of pollen grain in *Myosotis*

[Govt.MQP-2019; Aug-2021]

- (a) 10 micrometer
- (b) 20 micrometer
- (c) 200 micrometer
- (d) 2000 micrometer

[Ans. (a) 10 micrometer]

6. First cell of male gametophyte in angiosperm is

[Mar-2020; May-'22]

- (a) Microspore
- (b) Megaspore
- (c) Nucleus
- (d) Primary Endosperm Nucleus

[Ans. (a) Microspore]

7. Match the following

- I. External Fertilization – (i) Pollen grain
- II. Androecium – (ii) anther wall
- III. Male gametophyte – (iii) algae
- IV. Primary parietal layer – (iv) Stamens
- (a) I – iv ; II – i ; III – ii ; IV – iii
- (b) I – iii ; II – iv ; III – i ; IV – ii
- (c) I – iii ; II – iv ; III – ii ; IV – i
- (d) I – iii ; II – i ; III – iv ; IV – ii

[Ans. (b) I – iii ; II – iv ; III – i ; IV – ii]

8. Arrange the layers of anther wall from locus to periphery

- (a) Epidermis, middle layers, tapetum, endothecium.
- (b) Tapetum, middle layers, epidermis, endothecium.
- (c) Endothecium, epidermis, middle layers, tapetum.
- (d) Tapetum, middle layers, endothecium, epidermis.

[Ans. (d) Tapetum, middle layer, endothecium, epidermis]

9. Identify the incorrect pair.

- (a) Sporopollenin – Exine of pollen grain
- (b) Tapetum – Nutritive tissue for developing microspores.
- (c) Nucellus – Nutritive tissue for developing embryo.
- (d) Obturator – directs the pollen tube into micropyle

[Ans. (c) Nucellus – Nutritive tissue for developing embryo]

10. Assertion : Sporopollenin preserves pollen in fossil deposits.

Reason : Sporopollenin is resistant to physical and biological decomposition.

- (a) assertion is true; reason is false
- (b) assertion is false; reason is true
- (c) Both assertion and reason are not true
- (d) Both assertion and reason are true

[Ans. (d) Both assertion and reason are true]





11. Choose the correct statement(s) about **tenuinucellate ovule** \_\_\_\_\_.

- (a) Sporogenous cell is hypodermal
- (b) Ovules have fairly large nucellus
- (c) Sporogenous cell is epidermal
- (d) Ovules have single layer of nucellus tissue

**[Ans. (a) Sporogenous cell is hypodermal & (d) Ovules have single layer of nucellus tissue]**

12. Which of the following represent megagametophyte?

- (a) Ovule
- (b) Embryo sac
- (c) Nucellus
- (d) Endosperm

**[Ans. (b) Embryo sac]**

13. In *Haplopappus gracilis*, number of chromosomes in cells of nucellus is 4. What will be the chromosome number in primary endosperm cell? [July-'22]

- (a) 8
- (b) 12
- (c) 6
- (d) 2

**[Ans. (b) 12]**

14. Transmitting tissue is found in \_\_\_\_\_.

- (a) Micropylar region of ovule
- (b) Pollen tube wall
- (c) Styler region of gynoecium
- (d) Integument

**[Ans. (c) Styler region of gynoecium]**

15. The scar left by funiculus in the seed is

[May-'22]

- (a) tegmen
- (b) radicle
- (c) epicotyl
- (d) hilum

**[Ans. (d) hilum]**

16. A plant called X possesses small flower with reduced perianth and versatile anther. The probable agent for pollination would be [QY-2019]

- (a) water
- (b) air
- (c) butterflies
- (d) beetles

**[Ans. (b) air]**

17. Consider the following statement(s)

- (i) In Protandrous flowers pistil matures earlier.
- (ii) In Protogynous flowers pistil matures earlier.
- (iii) Herkogamy is noticed in unisexual flower.
- (iv) Distyly is present in *Primula*.

- (a) (i) and (ii) are correct
- (b) (ii) and (iv) are correct
- (c) (ii) and (iii) are correct
- (d) (i) and (iv) are correct

**[Ans. (b) (ii) and (iv) are correct]**

18. Coelorrhiza is found in

[July-'22]

- (a) Paddy
- (b) Bean
- (c) Pea
- (d) Tridax

**[Ans. (a) Paddy]**

19. Parthenocarpic fruits lack

[Aug-2021; FRT-'22]

- (a) Endocarp
- (b) Epicarp
- (c) Mesocarp
- (d) Seed

**[Ans. (d) Seed]**

20. In majority of plants, pollen is liberated at

- (a) 1 celled stage
- (b) 2 celled stage
- (c) 3 celled stage
- (d) 4 celled stage

**[Ans. (b) 2 celled stage]**

21. What is reproduction?

**Ans. (i)** Reproduction is a vital process for the existence of a species.

**(ii)** It brings suitable changes through variation in the off springs for their survival on Earth.

**(iii)** Plant reproduction is important for the continuation and existence of all other organisms. Since the latter directly (or) indirectly depend on plants.

22. Mention the contribution of Hofmeister towards Embryology.

**Ans. (i)** He worked on flowering plant embryology.

**(ii)** Discovered alternation of generation in plants

**(iii)** In the year of 1848, He described the structure of pollen tetrad.

23. List out two sub-aerial stem modifications with example.

**Ans. (i)** Runner – *Centella asiatica*

**(ii)** Sucker – *Chrysanthemum*

**(iii)** Stolon – *Mentha* and *Fragaria*

**(iv)** offset – *Pistia*, *Eichhornia*, etc

24. What is layering?

**Ans. (i)** Layering is a conventional method (artificial method) of plant propagation.

**(ii)** The stem of a parent plant is allowed to develop roots while still intact.

**(iii)** When the root develops, the rooted part is cut and planted to grow as a new plant.

**Example :** *Ixora* and *Jasminum*.

**(iv) Types:** ✦ Mound layering

✦ Air layering



## 25. What are clones?

**Ans.** The individuals formed by asexual reproduction are **morphologically and genetically** identical are called clones.

## 26. A detached leaf of *Bryophyllum* produces new plants. How?

**Ans. (i)** *Bryophyllum* undergoes vegetative reproduction by leaf.

**(ii)** In the leaf margins of *Bryophyllum* plant, there is a special buds (adventitious buds) called epiphyllous buds are developed.

**(iii)** These buds on leaf margins, detached from the parent plant and grow into new individual plants.

## 27. Differentiate Grafting and Layering.

**Ans.**

	Grafting	Layering
1.	Two different plants are involved.	Only parent plant is involved.
2.	Parts of two different plants are joined and continue to grow as one plant.	Stem of the parent plant is allowed to develop roots.
3.	Plant used for grafting is called scion.	The rooted part is cut and grown as a new plant.
4.	Shows characteristic of scion.	Results in propagation of parent plant.
5.	<b>Eg.</b> Citrus, Mango and Apple.	<b>Eg.</b> <i>Ixora</i> and <i>Jasminum</i> .

## 28. "Tissue culture is the best method for propagating rare and endangered plant species"- Discuss.

**Ans.** Micropropagation is one of the best method for propagating rare and endangered plant. The regeneration of a whole plant can be done from single cell, tissue or small pieces of vegetative structures through tissue culture is called micropropagation.

**It's a best method because,**

**(i)** Plants with desired characteristics can be multiplied in a short duration.

**(ii)** Plants produced are genetically identical.

**(iii)** It can be carried out in any season.

**(iv)** Plants which do not produce viable seeds and seeds that are difficult to germinate can be propagated by tissue culture.

**(v)** Thus this method is ideal to propagate rare and endangered plants.

## 29. Distinguish Mound layering and Air layering.

**Ans.**

	Mound Layering	Air Layering
1.	Lower branch is bent to the ground and buried in the soil and tip of the branch is exposed above the soil.	The stem is girdled at nodal region and hormones are applied to this region which promotes rooting.
2.	Applicable for plants with flexible branches.	Applicable for flexible and non-flexible branches.
3.	A cut is made in parent plant so the buried part grow into a new plant after root formation.	Branches removed from the parent plant and grown in a separate pot or ground after root formation.

## 30. Explain the conventional methods adopted in vegetative propagation of higher plants.

**Ans. Conventional methods:**

Methods of conventional propagation are cutting, grafting and layering.

### (a) Cutting:

**(i)** Producing a new plant by cutting the plant parts such as root, stem and leaf from the parent plant.

**(ii)** The cut part is placed in a suitable medium to produce root and grows into a new plant.

**(iii)** Depending upon the part used they are named as

\* root cutting (*Malus*),

\* stem cutting (*Hibiscus*, *Bougainvillea* and *Moringa*) and

\* leaf cutting (*Begonia*, *Bryophyllum*).

**(iv)** Stem cutting is widely used for propagation.





GOVERNMENT EXAM QUESTIONS

Bio-Botany (Short version)

CHOOSE THE CORRECT ANSWERS

1 MARK

1. Match the following

[QY-2019]

	Column-A		Column - B
i	Syngenesious	A	Pollen grain
ii	Androecium	B	Anther wall
iii	Male gametophyte	C	Asteraceae
iv	Primary Parietal Layer	D	Stamens

i	ii	iii	iv
(a) D	A	B	C
(b) C	D	A	B
(c) C	D	B	A
(d) C	A	D	B

[Ans. (b) i-C, ii-D, iii-A, iv-B]

2. Identify the type of embryo state →

[HY-2019]

- (a) Zygote
- (b) Globular embryo
- (c) Mature embryo
- (d) 4 celled embryo



[Ans. (b) Globular embryo]

3. Circinotropous ovule is found in the family :

[FRT-'22]

- (a) Primulaceae
- (b) Alismataceae
- (c) Cactaceae
- (d) Leguminosae

[Ans. (c) Cactaceae]

4. An example for Dioecious plant :

[FRT-'22]

- (a) Carica
- (b) Castor
- (c) Maize
- (d) Coconut

[Ans. (a) Carica]

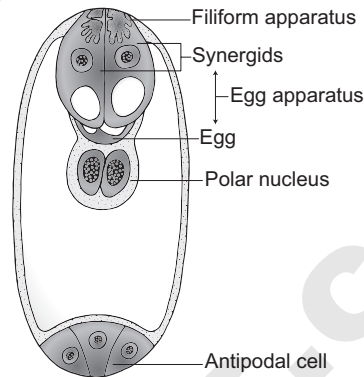
VERY SHORT ANSWERS

2 MARKS

1. Draw and label the structure of Embryo sac.

Ans.

[HY-2019]



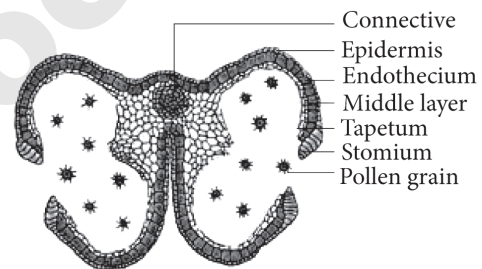
SHORT ANSWERS

3 MARKS

1. Draw and label the T.S. of mature anther.

Ans.

[QY-2019; Mar-2020; Aug-2021]



2. Write any three practical applications of polyembryony.

[Sep-2020]

Ans. Practical applications of polyembryony :

- (i) The seedlings formed from the nucellar tissue in *Citrus* are found better clones for Orchards.
- (ii) Embryos derived through polyembryony are found virus free.
- (iii) Polyembryony has ecological significance as it increases the probability of survival under different conditions.

3. What is apomixis?

[FRT-'22]

Ans. Apomixis : Reproduction does not involve union of male and female gametes is called apomixis. The term Apomixis was introduced by Winkler in the year 1908. It is defined as the substitution of the usual sexual system (Amphimixis) by a form of reproduction which does not involve meiosis and syngamy.



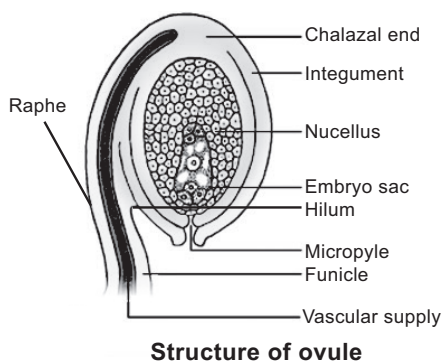
Maheswari (1950) classified Apomixis into two types - Recurrent and Non recurrent

- (i) **Recurrent apomixis:** It includes vegetative reproduction and agamospermy
- (i) **Non recurrent apomixis:** Haploid embryo sac developed after meiosis, develops into a embryo without fertilization.

**4. Draw and label the parts of Ovule.**

**Ans.**

[FRT-'22]

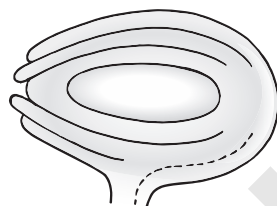


Structure of ovule

**5. Draw and explain Hemianatropous Ovule with an example.**

**Ans.**

[July-'22]



Hemianatropous

In this, the body of the Ovule is placed transversely and at right angles to the funicle.

**LONG ANSWERS**

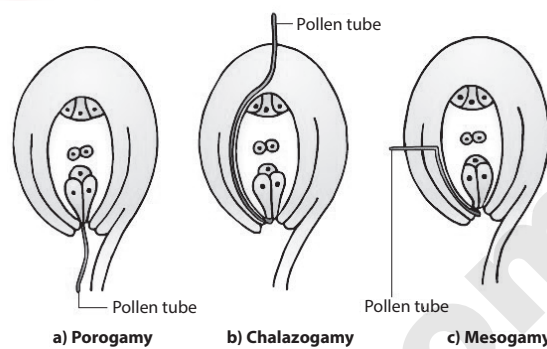
**5 MARKS**

**1. Explain the different mode of entry of pollen tube into the ovule.**

[Mar-2020]

**Ans. Entry of pollen tube into the ovule:** There are three types of pollen tube entry into the ovule.

- (i) **Porogamy:** when the pollen tube enters through the micropyle.
- (ii) **Chalazogamy:** when the pollen tube enters through the chalaza.
- (iii) **Mesogamy:** when the pollen tube enters through the integument.



Path of pollen tube entry into the ovule

**Botany (Long version)**

**CHOOSE THE CORRECT ANSWERS**

**1 MARK**

**1. From the following which one is the column of sterile tissue surrounded by the anther lobe :**

[Mar-2020]

- (a) periplasmodium (b) pollen chamber
- (c) connective tissue (d) tapetum

**[Ans. (c) connective tissue]**

**2. Cantharophily is :**

[Sep-2020]

- (a) Bees (b) Butterflies
- (c) Flies (d) Beetles

**[Ans. (d) Beetles]**

**3. \_\_\_\_\_ is popularly called "Terror of Bengal"**

[FRT-'22]

- (a) Murraya (b) Dalbergia
- (c) Eichhornia crassipes (d) Pistia

**[Ans. (c) Eichhornia crassipes]**

**4. Vegetative reproduction by root is found in \_\_\_\_\_**

[FRT-'22]

- (a) Bryophyllum (b) Curcuma longa
- (c) Mentha (d) Murraya

**[Ans. (d) Murraya]**

**5. The size of the pollen in "Myosotis" is**

[FRT-'22]

- (a) From 10 micrometers to 100 micrometers
- (b) From 10 micrometers to 50 micrometers
- (c) From 10 micrometers to 300 micrometers
- (d) From 10 micrometers to 200 micrometers

**[Ans. (d) From 10 micrometers to 200 micrometers]**

**6. \_\_\_\_\_ is an example for pollinium.**

[FRT-'22]

- (a) Drosera (b) Calotropis
- (c) Drymis (d) Sporopollenin

**[Ans. (b) Calotropis]**





7. An example for cellular endosperm [FRT-'22]

- (a) Valisneria (b) Arachis  
(c) Helianthus (d) Hydrilla

[Ans. (c) Helianthus]

8. Choose the correct pair: [FRT-'22]

- (a) Ovary - Seed (b) Ovule - Zygote  
(c) Egg - Fruit  
(d) Nucellus - Perisperm

[Ans. (d) Nucleus - Perisperm]

9. The appropriate temperature used for cyopreservation: [July-'22]

- (a) 196°C (b) - 196°C  
(c) 100°C (d) - 100°C

[Ans. (b) - 196°C]

#### VERY SHORT ANSWERS

2 MARKS

1. What is called Parthenocarpic fruits? Give an example. [Mar-2020]

**Ans. (i)** Fruit like structures develop from the ovary without the act of fertilization. Such fruits are called **parthenocarpic fruits**.

**(ii)** They will not have true seeds

**(iii)** Example of commercial seedless fruits are Banana, Grapes and Papaya.

2. Write the types of cell based on the position of sporogenous cell. [Sep-2020]

**Ans. (i)** Tenuinucellate type

**(ii)** Crassinucellate type.

#### SHORT ANSWERS

3 MARKS

1. Define epiphyllous bud. [Sep-2020]

**Ans.** Adventitious buds develop at the notches of Bryophyllum are called **epiphyllous buds**. They develop into new plants forming a root system and become independent plants when the leaf gets decayed. It is a method of vegetative reproduction.

2. What is meant by polyembryony? [FRT-'22]

**Ans.** Occurrence of more than one embryo in a seed is called polyembryony. The first case of polyembryony was reported in certain oranges by Anton von Leeuwenhoek in the year 1719. Polyembryony is divided into four categories based on its origin.

3. Draw and label the structure of Embryo sac.

[May & July-'22]

\* Refer Short version Government Exam Questions - 2 Marks - Q.No.1

4. Draw and label the parts of Ovule. [FRT-'22]

\* Refer Short version Government Exam Questions - 3 Marks - Q.No.4

#### LONG ANSWERS

5 MARKS

1. What is tapetum? Write its types and function.

[May-'22]

**Ans. Tapetum:** It is the innermost layer of anther wall and attains its maximum development at the tetrad stage of microsporogenesis. It is derived partly from the peripheral wall layer and partly from the connective tissue of the anther lining the anther locule. Thus, the tapetum is dual in origin.

There are two types of tapetum based on its behaviour. They are:

**(i) Secretory tapetum** (parietal / glandular/cellular): The tapetum retains the original position and cellular integrity and nourishes the developing microspores.

**(ii) Invasive tapetum** (periplasmodial): The cells lose their inner tangential and radial walls and the protoplast of all tapetal cells coalesces to form a periplasmodium.

#### Functions of Tapetum :

**(i)** It supplies nutrition to the developing microspores.

**(ii)** The pollenkit material is contributed by tapetal cells and is later transferred to the pollen surface.

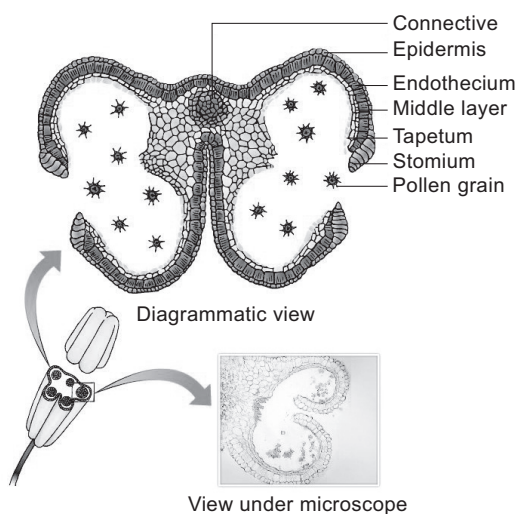
**(iii)** It contributes sporopollenin through **ubisch bodies** pollen wall formation.

**(iv)** Exine proteins responsible for 'rejection reaction' of the stigma are present in the cavities of the exine. These proteins are derived from tapetal cells.

2. Explain T.S. of Mature Anther. [FRT-'22]

**Ans. T.S. of Mature Anther :**

Transverse section of mature anther reveals the presence of anther cavity surrounded by an anther wall. It is bilobed, each lobe having 2 theca (ditheous).



T.S of Mature anther

### 1. Anther wall :

The mature anther wall consists of the following layers

- Epidermis
- Endothecium
- Middle layers
- Tapetum.

**a. Epidermis:** It is single layered and protective in function. The cells undergo repeated anticlinal divisions to cope up with the rapidly enlarging internal tissues.

### b. Endothecium:

- (i) It is generally a single layer of radially elongated cells found below the epidermis. The inner tangential wall develops bands (sometimes radial

walls also) of a cellulose (sometimes also slightly lignified). The cells are hygroscopic.

- (ii) The cells along the junction of the two sporangia of an anther lobe lack these thickenings. This region is called stomium.

**c. Middle layers:** Two to three layers of cells next to endothecium constitute middle layers. They are generally ephemeral. They disintegrate or get crushed during maturity.

### d. Tapetum:

- (i) It is the innermost layer of anther wall and attains its maximum development at the tetrad stage of microsporogenesis. It is derived partly from the peripheral wall layer and partly from the connective tissue of the anther lining the anther locule.

- (ii) Tapetum also controls the fertility or sterility of the microspores or pollen grains.

**2. Anther Cavity:** The anther cavity is filled with microspores in young stages or with pollen grains at maturity. The meiotic division of microspore mother cells gives rise to microspores which are haploid in nature.

**3. Connective:** It is the column of sterile tissue surrounded by the anther lobe. It possesses vascular tissues. It also contributes to the inner tapetum.

## ADDITIONAL QUESTIONS AND ANSWERS

### CHOOSE THE CORRECT ANSWERS

1 MARK

### I. CHOOSE THE CORRECT ANSWER:

1. PEN is referred as \_\_\_\_\_.

- Primary Endo Nutritive tissue.
- Primary Endosperm Nucleus.
- Primary Entry of Nucleus.
- Post Entry of Nucleus.

[Ans. (b) Primary Endosperm Nucleus]

2. How do you call the fertilized ovule?

- Embryo
- Seed
- Endosperm
- Nutritive tissue

[Ans. (b) Seed]

3. Which one of the following is converted into endosperm after fertilization?

- Egg
- Funicle
- Secondary Nucleus
- Nucellus

[Ans. (c) Secondary Nucleus]





4. Who initiated embryo culture?  
(a) D. A. Johansen (b) E. Hanning  
(c) G. B. Amici (d) J. G. Kolrecuter  
[Ans. (b) E. Hanning]
5. Who discovered the pollen tube?  
(a) G. B. Amici (b) E. Strasburger  
(c) Hanstein (d) D. A. Johansen  
[Ans. (a) G. B. Amici]
6. Sexual reproduction of higher plants include \_\_\_\_\_ stages.  
(a) 2 (b) 4 (c) 3 (d) 5  
[Ans. (c) 3]
7. Androecium is made up of \_\_\_\_\_.  
(a) Megasporyphyll (b) Pistil  
(c) Sepals (d) Stamens  
[Ans. (d) Stamens]
8. New plants formed by asexual reproduction method are morphologically and genetically uniform and called as \_\_\_\_\_.  
(a) spores (b) buds  
(c) clones (d) gemma  
[Ans. (c) Clones]
9. An example of protandry is \_\_\_\_\_.  
(a) *Helianthus* and *Borassus*  
(b) *Helianthus* and *Clerodendron*  
(c) *Scrophularia* and *Aristolochia*  
(d) *Scrophularia* and *Aristolochia*  
[Ans. (b) *Helianthus* and *Clerodendron*]
10. Pollen deposits on another flower of same individual plant is called \_\_\_\_\_.  
(a) Geitonogamy (b) Xenogamy  
(c) Homogamy (d) Cleistogamy  
[Ans. (a) Geitonogamy]
11. Find out the character which is not suitable for anemophilous plants.  
(a) Spike inflorescence (b) Perianth is absent  
(c) Flowers are small (d) Scented flowers  
[Ans. (d) Scented flowers]
12. Pollination by slugs and snails is called \_\_\_\_\_.  
(a) Ornithophily (b) Entomophily  
(c) Malacophily (d) Myrmecophily  
[Ans. (c) Malacophily]
13. Who classified parthenocarpy?  
(a) Nitsch, 1963 (b) Maheswari, 1950  
(c) Winkler, 1908 (d) Guignard, 1898  
[Ans. (a) Nitsch, 1963]
14. The funiculus disappears and leaves a scar called \_\_\_\_\_.  
(a) Micropyle (b) Tegmen  
(c) Testa (d) Hilum  
[Ans. (d) Hilum]
15. Who proposed double fertilization?  
(a) S. G. Nawaschin and L. Guignard in 1898.  
(b) Carolus Linnaeus in 1753  
(c) Bentham & Hooker in 1895  
(d) Engler & Prantl in 1859  
[Ans. (a) S. G. Nawaschin and L. Guignard in 1898]
16. Megaspore arises from \_\_\_\_\_.  
(a) Integument (b) Nucellus  
(c) Placenta (d) Raphe  
[Ans. (c) Placenta]
17. An example for herkogamy.  
(a) *Aristolochia* (b) *Gloriosa*  
(c) *primula* (d) *Lythrum*  
[Ans. (b) *Gloriosa*]
18. Pollination by an ant is called \_\_\_\_\_.  
(a) Malacophily (b) Entomophily  
(c) Myrmecophily (d) Chiropterophily.  
[Ans. (c) Myrmecophily]
19. Piston mechanism of pollination is found in \_\_\_\_\_.  
(a) *Aristolochia* (b) *Arum*  
(c) *Asclepiadaceae* (d) *Papilionaceae*  
[Ans. (d) *Papilionaceae*]
20. Apospory is seen in \_\_\_\_\_.  
(a) Citrus (b) *Aerva*  
(c) *Parthenium* (d) *Eupatorium*  
[Ans. (c) *Parthenium*]
21. *Vallisneria Spiralis* is \_\_\_\_\_.  
(a) Polygamous (b) Monoecious  
(c) Dioecious (d) Prisexual  
[Ans. (c) Dioecious]



22. In *Adansonia digitata*, Pollination is carried out by \_\_\_\_\_.

- (a) Ant (b) Bat  
(c) Water (d) Wind

[Ans. (b) Bat]

23. The second gamete migrates to the central cell and fuses with the \_\_\_\_\_.

- (a) polar nuclei (b) zygote  
(c) obturator (d) corpusculum

[Ans. (a) polar nuclei]

24. Hollow style is also called as \_\_\_\_\_.

- (a) closed style (b) solid style  
(c) open style (d) semi-solid style

[Ans. (c) open style]

25. \_\_\_\_\_ discovered the process of syngamy.

- (a) E. Strasburger (b) E. Hanning  
(c) G. B. Amici (d) Hanstein

[Ans. (a) E. Strasburger]

26. Adventitious buds on roots are seen in \_\_\_\_\_.

- (a) *Ipomoea* (b) *Pistia*  
(c) Strawberry (d) *Agave*

[Ans. (a) *Ipomoea*]

27. \_\_\_\_\_ is an example for sucker.

- (a) *Dioscorea* (b) *Chrysanthemum*  
(c) *Bryophyllum*  
(d) *Murraya* [Ans. (b) *Chrysanthemum*]

28. Tunicated bulb is seen in \_\_\_\_\_.

- (a) *Scilla* (b) *Solanum*  
(c) *Allium* (d) *Zingiber*

[Ans. (c) *Allium*]

29. Layering is in \_\_\_\_\_.

- (a) *Hibiscus* (b) *Rose*  
(c) *Jasminum* (d) *Citrus*

[Ans. (c) *Jasminum*]

## II. MATCH THE FOLLOWING :

1. A	Gemma	(i)	<i>Hydra</i>
B	Budding	(ii)	<i>Aspergillus</i>
C	Conidia	(iii)	<i>Marchantia</i>
D	Binary fission	(iv)	<i>Bacteria</i>

A	B	C	D
(a) iii	i	ii	iv
(b) ii	i	iii	iv
(c) iii	ii	iv	i
(d) i	iii	ii	iv

[Ans. (a) A – iii, B – i, C – ii, D – iv]

2. A	Parietal tapetum	(i)	Pollen wall formation
B	Periplasmodial tapetum	(ii)	Secretory tapetum
C	Ubisch bodies	(iii)	Exine proteins
D	Rejection reaction	(iv)	Invasive tapetum

A	B	C	D
(a) i	ii	iii	iv
(b) ii	i	iii	iv
(c) ii	iv	i	iii
(d) i	iii	ii	iv

[Ans. (c) A-ii, B – iv, C-i, D-iii ]

3. A	Endothelium	(i)	Polygonaceae
B	Orthotropous	(ii)	Alismataceae
C	Amphitropous	(iii)	Cactaceae
D	Circinotropous	(iv)	Asteraceae

A	B	C	D
(a) iv	i	ii	iii
(b) ii	i	iii	iv
(c) ii	iv	i	iii
(d) i	iii	ii	iv

[Ans. (a) A –(iv), B- (i), C – (ii), D (iii)]

4. A	Tristyly	(i)	<i>Primula</i>
B	Distyly	(ii)	<i>Vallisneria</i>
C	Anemophily	(iii)	<i>Lythrum</i>
D	Hydrophily	(iv)	<i>Eichhornia bamboo</i>

A	B	C	D
(a) iv	i	ii	iii
(b) ii	i	iii	iv
(c) iii	i	iv	ii
(d) i	iii	ii	iv

[Ans. (c) A-iii, B-i, C – iv, D –ii]



## UNIT VII : Genetics

### Chapter

### 2

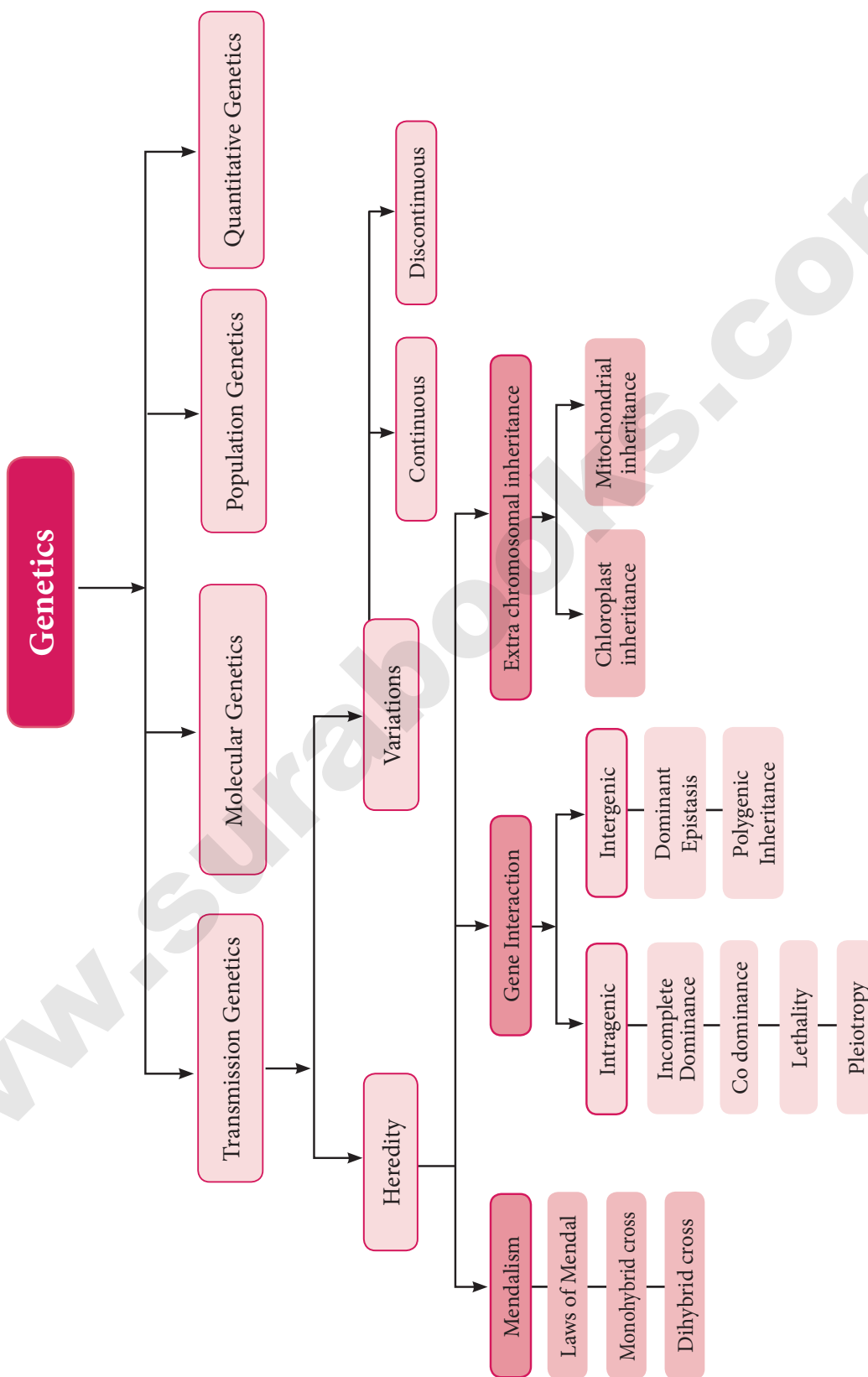
# CLASSICAL GENETICS

## Chapter Snapshot

- |  |  |
|--|--|
| <b>2.1</b> Heredity and Variation                                    | <b>2.3.5</b> The Dihybrid Test Cross   |
| <b>2.2</b> Mendelism   | <b>2.3.7</b> Extensions of Mendelian Genetics  |
| <b>2.2.1</b> Father of Genetics – Gregor Johann Mendel (1822 – 1884) | <b>2.4</b> Intragenic interactions.  |
| <b>2.2.2</b> Mendel's Experiments on Pea Plant                       | <b>2.4.1.</b> Incomplete Dominance – No blending of Genes  |
| <b>2.2.3</b> Terminology Related to Mendelism                        | <b>2.4.2.</b> Codominance (1 : 2 : 1)  |
| <b>2.2.4</b> Mendelian Inheritance – Mendel's Laws of Heredity       | <b>2.4.3.</b> Lethal genes   |
| <b>2.3</b> Monohybrid cross  | <b>2.4.4.</b> Pleiotropy – A single gene Affects Multiple Traits                                   |
| <b>2.3.1</b> Mendel's Analytical and empirical Approach              | <b>2.5</b> Intergenic Interactions   |
| <b>2.3.2</b> Test Cross  | <b>2.6</b> Polygenic inheritance in Wheat (Kernel Colour)  |
| <b>2.3.3</b> Back Cross  | <b>2.7</b> Extra chromosomal Inheritance - or Extra Nuclear Inheritance- (Cytoplasmic Inheritance) |
| <b>2.3.4</b> Dihybrid Cross  |  |



## Concept Map





## MUST KNOW DEFINITIONS

<b>Alleles</b>	: Alternative forms of a gene.
<b>Back Cross</b>	: Crosses between $F_1$ off-springs with either of the two parents (hybrid) are known as back cross.
<b><math>F_1</math> / First Filial Generation</b>	: The second stage of Mendel's experiment is called $F_1$ generation.
<b>Gene</b>	: The determinant of a characteristic of an organism (Mendelian factor).
<b>Genetic Code</b>	: The set of 64 triplets of bases (codons) corresponding to the twenty amino acids in proteins and the signals for initiation and termination of polypeptide synthesis.
<b>Genotype</b>	: The types of alleles in a single individual is called genotype.
<b>Genome</b>	: The total complement of genes contained in a cell.
<b>Heterozygous</b>	: Diploid organisms that have two different alleles at a specific gene locus are said to be heterozygous.
<b>Homozygous</b>	: A diploid organism in which both alleles are the same at a given gene locus is said to be homozygous.
<b>Hybrid Vigour or Heterosis</b>	: The superiority of hybrid over either of its parents in one or more traits.
<b>Locus</b>	: The site or position of a particular gene on a chromosome.
<b>Phenotype</b>	: The physical expression of an individuals gene. The physical observable characteristics of an organism.
<b>Punnett Square / Checkerboard</b>	: A sort of cross-multiplication matrix used in the prediction of the outcome of a genetic cross, in which male and female gametes and their frequencies are arranged along the edges.
<b>Lethal genes</b>	: An allele which has the potential to cause the death of an organism.
<b>Extra nuclear inheritance</b>	: Traits are governed either by the chloroplast or mitochondrial genes.
<b>Pleiotropy</b>	: A single gene affecting multiple traits and thus alters the phenotype of an organism.
<b>Codominance</b>	: A type of intragenic interaction in which simultaneous expression of both alleles occurs in the heterozygote.
<b>Incomplete dominance</b>	: One allele is not completely dominant over another alleles and the phenotype is a blend of expression of both alleles. Also called blending inheritance.
<b>Gene interaction</b>	: A single phenotype is controlled by more than one set of genes, each of which has two or more alleles. This phenomenon is called gene interaction.



## TERMINOLOGIES & EXAMPLES

<b>Monohybrid cross</b>	: Mendel – <i>Pisum sativum</i> - 3 : 1
<b>Dihybrid cross</b>	: Mendel – <i>Pisum sativum</i> – 9 : 3 : 3 : 1
<b>Dominant Epistasis</b>	: Sinnot – summer squash – 12 : 3 : 1
<b>Gregor Johann Mendel</b>	: Father of Genetics
<b>Mendel's paper</b>	: Experiments on Plant Hybridisation
<b>Emasculation</b>	: Removal of Anthers
<b>Genotype</b>	: Gene constitution of an organism
<b>Phenotype</b>	: Observable character of an organism
<b>Homozygous</b>	: Genes are alike [TT, tt]
<b>Heterozygous</b>	: Genes are dissimilar [Tt]
<b>Allele</b>	: Gene exists in alternative forms called alleles.

<b>Dihybrid test cross</b>	: 1 : 1 : 1 : 1
<b>Trihybrid cross</b>	: 27 : 9 : 9 : 9 : 3 : 3 : 3 : 1
<b>Incomplete dominance</b>	: (eg) <i>Mirabilis Jalapa</i> – 1 : 2 : 1 Carl Correns
<b>Codominance</b>	: (eg) <i>Camellia</i> , <i>Gossypium</i> , ABO Blood group
<b>Lethal gene</b>	: 1907 – E. Baur – (eg) Snapdragon
<b>Polygenic Inheritance</b>	: (eg) Kernel colour in wheat H. Nilson – Ehle (1909) Ratio 1 : 4 : 6 : 4 : 1
<b>Chloroplast inheritance</b>	: <i>Mirabilis jalapa</i>
<b>Mitochondrial Inheritance</b>	: <i>Hordeum vulgare</i>
<b>Atavism</b>	: <i>Hieracium pilosella</i>





## EVALUATION

1. Extra nuclear inheritance is a consequence of presence of genes in
  - (a) Mitochondria and chloroplasts
  - (b) Endoplasmic reticulum and mitochondria
  - (c) Ribosomes and chloroplast
  - (d) Lysosomes and ribosomes

[Ans. (a) Mitochondria and chloroplasts]
2. In order to find out the different types of gametes produced by a pea plant having the genotype AaBb, it should be crossed to a plant with the genotype [July-'22]
  - (a) aaBB
  - (b) AaBB
  - (c) AABb
  - (d) aabb

[Ans. (d) aabb]
3. How many different kinds of gametes will be produced by a plant having the genotype AABbCC? [Govt.MQP-2019]
  - (a) Three
  - (b) Four
  - (c) Nine
  - (d) Two

[Ans. (b) Four]
4. Which one of the following is an example of polygenic inheritance?
  - (a) Flower colour in *Mirabilis jalapa*
  - (b) Production of male honey bee
  - (c) Pod shape in garden pea
  - (d) Skin colour in humans

[Ans. (d) Skin colour in humans]
5. In Mendel's experiments with garden pea, round seed shape (RR) was dominant over wrinkled seeds (rr), yellow cotyledon (YY) was dominant over green cotyledon (yy). What are the expected phenotypes in the  $F_2$  generation of the cross  $RRYY \times rryy$ ? [Aug-2021]
  - (a) Only round seeds with green cotyledons
  - (b) Only wrinkled seeds with yellow cotyledons
  - (c) Only wrinkled seeds with green cotyledons
  - (d) Round seeds with yellow cotyledons and wrinkled seeds with yellow cotyledons

[Ans. (d) Round seeds with yellow cotyledons and wrinkled seeds with yellow cotyledons]
6. Test cross involves
  - (a) Crossing between two genotypes with recessive trait
  - (b) Crossing between two  $F_1$  hybrids
  - (c) Crossing the  $F_1$  hybrid with a double recessive genotype
  - (d) Crossing between two genotypes with dominant trait

[Ans. (a) Crossing between two genotypes with recessive trait]
7. In pea plants, yellow seeds are dominant to green. If a heterozygous yellow seed plant is crossed with a green seeded plant, what ratio of yellow and green seeded plants would you expect in  $F_1$  generation?
  - (a) 9 : 1
  - (b) 1 : 3
  - (c) 3 : 1
  - (d) 50 : 50

[Ans. (d) 50 : 50]
8. The genotype of a plant showing the dominant phenotype can be determined by [Aug-2021]
  - (a) Back cross
  - (b) Test cross
  - (c) Dihybrid cross
  - (d) Pedigree analysis

[Ans. (b) Test cross]
9. Select the correct statement from the ones given below with respect to dihybrid cross
  - (a) Tightly linked genes on the same chromosomes show very few combinations.
  - (b) Tightly linked genes on the same chromosomes show higher combinations.
  - (c) Genes far apart on the same chromosomes show very few recombinations
  - (d) Genes loosely linked on the same chromosome show similar recombinations as the tightly linked ones

[Ans. (a) Tightly linked genes on the same chromosomes show very few combinations]



**10. Which Mendelian idea is depicted by a cross in which the  $F_1$  generation resembles both the parents?**

- (a) Incomplete dominance
- (b) Law of dominance
- (c) Inheritance of one gene
- (d) Co-dominance

**[Ans. (d) Co-dominance]**

**11. Fruit color in squash is an example of**

- (a) Recessive epistasis
- (b) Dominant epistasis
- (c) Complementary genes
- (d) Inhibitory genes

**[Ans. (b) Dominant epistasis]**

**12. In his classic experiments on Pea plants, Mendel did not use** [Aug-2021]

- (a) Flowering position
- (b) Seed color
- (c) Pod length
- (d) Seed shape

**[Ans. (c) Pod length]**

**13. The epistatic effect, in which the dihybrid cross 9:3:3:1 between AaBb Aabb is modified as**

- (a) Dominance of one allele on another allele of both loci.
- (b) Interaction between two alleles of different loci.
- (c) Dominance of one allele to another alleles of same loci.
- (d) Interaction between two alleles of some loci.

**[Ans. (b) Interaction between two alleles of different loci]**

**14. In a test cross involving  $F_1$  dihybrid flies, more parental type offspring were produced than the recombination type offspring. This indicates**

- (a) The two genes are located on two different chromosomes.
- (b) Chromosomes failed to separate during meiosis.
- (c) The two genes are linked and present on the same chromosome.
- (d) Both of the characters are controlled by more than one gene.

**[Ans. (c) The two genes are linked and present on the same chromosome]**

**15. The genes controlling the seven pea characters studied by Mendel are known to be located on how many different chromosomes?** [FRT-'22]

- (a) Seven
- (b) Six
- (c) Five
- (d) Four

**[Ans. (d) Four]**

**16. Which of the following explains how progeny can possess the combinations of traits that none of the parent possessed?**

- (a) Law of segregation
- (b) Chromosome theory
- (c) Law of independent assortment
- (d) Polygenic inheritance

**[Ans. (b) Chromosome theory]**

**17. "Gametes are never hybrid". This is a statement of** [QY-2019]

- (a) Law of dominance
- (b) Law of independent assortment
- (c) Law of segregation
- (d) Law of random fertilization

**[Ans. (c) Law of segregation]**

**18. Gene which suppresses other genes activity but does not lie on the same locus is called as**

- (a) Epistatic
- (b) Supplement only
- (c) Hypostatic
- (d) Codominant

**[Ans. (a) Epistatic]**

**19. Pure tall plants are crossed with pure dwarf plants. In the  $F_1$  generation, all plants were tall. These tall plants of  $F_1$  generation were selfed and the ratio of tall to dwarf plants obtained was 3:1. This is called**

- (a) Dominance
- (b) Inheritance
- (c) Codominance
- (d) Heredity

**[Ans. (a) Dominance]**

**20. The dominant epistatis ratio is** [Sep-2020]

- (a) 9 : 3 : 3 : 1
- (b) 12 : 3 : 1
- (c) 9 : 3 : 4
- (d) 9 : 6 : 1

**[Ans. (b) 12 : 3 : 1]**

**21. Select the period for Mendel's hybridization experiments** [FRT-'22]

- (a) 1856-1863
- (b) 1850-1870
- (c) 1857-1869
- (d) 1870-1877

**[Ans. (a) 1856-1863]**





## GOVERNMENT EXAM QUESTIONS

### Bio-Botany (Short version)

#### CHOOSE THE CORRECT ANSWERS 1 MARK

1. If a homozygous red flowered plant is crossed with a homozygous white flowered plant then the off-spring will be: [Mar-2020]

(a) All red flowered (b) Half white flowered  
(c) Half red flowered (d) All white flowered

[Ans. (a) All red flowered]

2. Alternative forms of a gene are/is called: [Sep-2020]

(a) Genome (b) Alleles  
(c) Genotype (d) Genetic code

[Ans. (b) Alleles]

3. Find out the correct pair : [FRT-'22]

(a) Duplicate genes - 15 : 1  
(b) Supplementary genes - 9 : 7  
(c) Inhibitor genes - 9 : 3 : 4  
(d) Complementary genes - 13 : 3

[Ans. (a) Duplicate genes - 15 : 1]

4. The Dominant Epistasis ratio is: [May-'22]

(a) 9 : 3 : 4 (b) 9 : 3 : 3 : 1  
(c) 9 : 6 : 1 (d) 12 : 3 : 1

[Ans. (d) 12 : 3 : 1]

5. In \_\_\_\_\_ the single gene affects multiple traits and alters the phenotype of the organism. [July-'22]

(a) Lethal genes (b) Epistatic  
(c) Pleiotropy (d) Hypostatic

[Ans. (c) Pleiotropy]

#### VERY SHORT ANSWERS 2 MARKS

1. What do you know about pleiotropy?

[QY-2019; FRT-'22]

Ans. (i) The single gene affects multiple traits and alter the phenotype of an organism.

(ii) The pleiotropic gene influences number of characters simultaneously and such genes are called pleiotropic gene. Eg: sickle cell anaemia.

2. Define Atavism. [HY-2019]

Ans. It is a modification of biological structure where by an ancestral trait reappears after having been lost though evolutionary changes in the previous generation. Eg: Reemergence of sexual reproduction in the flowering plant *Hieracium pilosella*.

3. Define - Epistatic inheritance. [FRT-'22]

Ans. The gene that suppresses or masks the phenotypic expression of a gene at another locus is known as epistatic inheritance.

#### SHORT ANSWERS

3 MARKS

1. Why Mendel has chosen *pisum sativum* for his experiment? [HY-2019]

Ans. He chose pea plant because,

- (i) It is an annual plant and has clear contrasting characters that are controlled by a single gene separately.  
(ii) Self-fertilization occurred under normal conditions in garden pea plants. Mendel used both self-fertilization and cross-fertilization.  
(iii) The flowers are large hence emasculation and pollination are very easy for hybridization.

2. In 4 o'clock plant

[Mar-2020]

Pale green leaved plant (Male) × Dark green leaved plant (Female)

?

Explain the type of inheritance.

Pale green leaved plant × Dark green leaved plant

Ans.

F<sub>1</sub> Dark Green leaved

(Male)

(Female)

**Chloroplast Inheritance:**

- (i) It is found in 4 O' Clock plant (*Mirabilis jalapa*).  
(ii) In this, there are two types of variegated leaves namely dark green leaved plants and pale green leaved plants.

- (iii) When the pollen of dark green leaved plant (male) is transferred to the stigma of pale green leaved plant (female) and pollen of pale green leaved plant is transferred to the stigma of dark green leaved plant, the  $F_1$  generation of both the crosses must be identical as per Mendelian inheritance.
- (iv) But in the reciprocal cross the  $F_1$  plant differs from each other.
- (v) In each cross, the  $F_1$  plant reveals the character of the plant which is used as female plant.

### LONG ANSWERS


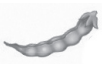


**5 MARKS**

1. (i) **Bring out the importance of variation. (any three).** [Sep-2020]
- (ii) **Write the gene of (i) Pod form (ii) Flower position of *Pisum sativum*.**

**Ans. (i)** Importance of variation:

- (a) **Variations** make some individuals better fitted in the struggle for existence.
- (b) They help the individuals to adapt themselves to the changing environment.
- (c) It provides the genetic material for natural selection.
- (d) Variations allow breeders to improve better yield, quicker growth, increased resistance and lesser input.
- (e) They constitute the raw materials for evolution

(ii)

Character	Gene	Dominant Trait	Recessive trait
Pod form	V	 Inflated	 Constricted
Flower Position	Fa	 Axial	 Terminal

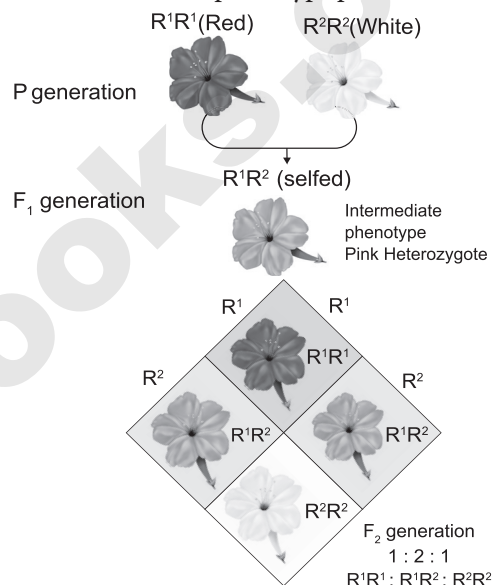
2. **Explain Incomplete Dominance with an example.** [FRT, May & July-'22]

**Ans. The German Botanist Carl Correns's (1905) Experiment :**

- (i) In 4 O' clock plant, *Mirabilis jalapa* when the pure breeding homozygous red ( $R^1R^1$ ) parent is crossed with homozygous white ( $R^2R^2$ ), the

phenotype of the  $F_1$  hybrid is heterozygous pink ( $R^1R^2$ ).

- (ii) The  $F_1$  heterozygous phenotype differs from both the parental homozygous phenotype. This cross did not exhibit the character of the dominant parent but an intermediate colour pink.
- (iii) When one allele is not completely dominant to another allele it shows incomplete dominance. Such allelic interaction is known as incomplete dominance.  $F_1$  generation produces intermediate phenotype pink coloured flower.



### Incomplete dominance

- (iv) When pink coloured plants of  $F_1$  generation were interbred in  $F_2$  both phenotypic and genotypic ratios were found to be identical as 1 : 2 : 1 (1 red : 2 pink : 1 white).
- (v) Genotypic ratio is 1  $R^1R^1$  : 2  $R^1R^2$  : 1  $R^2R^2$ . From this we conclude that the alleles themselves remain discrete and unaltered proving the Mendel's Law of Segregation.
- (vi)  $R^1$  allele codes for an enzyme responsible for the formation of red pigment.  $R^2$  allele codes for defective enzyme.  $R^1$  and  $R^2$  genotypes produce only enough red pigments to make the flower pink.
- (vii) It is very clear that Mendel's particulate inheritance takes place in this cross which is confirmed by the reappearance of original phenotype in  $F_2$ .



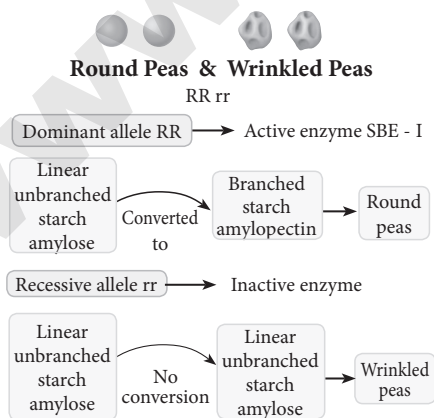
3. How does the wrinkled gene make Mendel's peas wrinkled? Give Molecular explanation.

[FRT-'22]

**Ans.** Wrinkled gene make Mendel's peas wrinkled & Molecular Explanation :

- (i) The protein called starch branching enzyme (SBEI) is encoded by the wild-type allele of the gene (RR) which is dominant. When the seed matures, this enzyme SBEI catalyzes the formation of highly branched starch molecules. Normal gene (R) has become interrupted by the insertion of extra piece of DNA (0.8 kb) into the gene, resulting in r allele.
- (ii) In the homozygous mutant form of the gene (rr) which is recessive, the activity of the enzyme SBEI is lost resulting in wrinkled peas. The wrinkled seed accumulates more sucrose and high water content. Hence the osmotic pressure inside the seed rises.
- (iii) As a result, the seed absorbs more water and when it matures it loses water as it dries. So it becomes wrinkled at maturation. When the seed has atleast one copy of normal dominant gene heterozygous, the dominant allele helps to synthesize starch, amylopectin an insoluble carbohydrate, with the osmotic balance which minimises the loss of water resulting in smooth structured round seed.

The wrinkled gene make Mendel's  
peas wrinkled



Molecular explanation of round and wrinkled peas

## Botany (Long version)

CHOOSE THE CORRECT ANSWERS

1 MARK

1. Match the following : [Mar-2020]
- |                         |                   |
|-------------------------|-------------------|
| (1) Dominant epistasis  | - (i) 9 : 7       |
| (2) Duplicate genes     | - (ii) 12 : 3 : 1 |
| (3) Recessive epistasis | - (iii) 15 : 1    |
| (4) Complementary genes | - (iv) 9 : 3 : 4  |
- (a) (1)-(iv), (2)-(i), (3)-(ii), (4)-(iii)  
 (b) (1)-(ii), (2)-(iii), (3)-(iv), (4)-(i)  
 (c) (1)-(i), (2)-(ii), (3)-(iii), (4)-(iv)  
 (d) (1)-(iii), (2)-(iv), (3)-(ii), (4)-(i)

[Ans. (b) (1)-(ii), (2)-(iii), (3)-(iv), (4)-(i)]

2. Among the pea plant cell which one has the ability to convert a precursor molecule into an active form? [Mar-2020]

- (a) Le le (b) GA1  
 (c) Le (d) le

[Ans. (b) GA1]

3. Lethal gene is find out in \_\_\_\_\_ species. [FRT-'22]

- (a) Antirrhinum (b) Summer Squash  
 (c) Wheat (d) Camellia

[Ans. (a) Antirrhinum]

4. Dominant epistasis ratio is [FRT-'22]

- (a) 9:3:4 (b) 12:3:1  
 (c) 9:6:1 (d) 1:2:1

[Ans. (b) 12 : 3 : 1]

5. Which one is the example for Pleiotropy?

- (a) Production of male honey bee [FRT-'22]  
 (b) Pod shape in garden pea  
 (c) Flower colour in Mirabilis jalapa  
 (d) None of the above

[Ans. (d) None of the above]

6. The recessive trait to the dominant trait of yellow cotyledon is: [May-'22]

- (a) Green cotyledon (b) White cotyledon  
 (c) Axial cotyledon  
 (d) Wrinkled cotyledon

[Ans. (a) Green cotyledon]

7. 'The Father of Genetics' is \_\_\_\_\_. [July-'22]

- (a) Mendel (b) W. Bateson  
 (c) E. Bar (d) Carl Correns

[Ans. (a) Mendel]





## ADDITIONAL QUESTIONS AND ANSWERS

### CHOOSE THE CORRECT ANSWERS

1 MARK

#### I. CHOOSE THE CORRECT ANSWER:

- Deals with the structure and function of a gene.  
(a) Molecular Genetics  
(b) Population Genetics  
(c) Classical Genetics  
(d) Quantitative Genetics  
[Ans. (a) Molecular Genetics]
- Identify the back cross  
(a)  $TT \times tt$   
(b)  $Tt \times tt$   
(c)  $Tt \times Tt$   
(d)  $Tt \times TT$   
[Ans. (b)  $Tt \times tt$ ]
- Genetics is described as a science which deals with \_\_\_\_\_.  
(a) Discontinuous variation  
(b) Continuous variation  
(c) Heredity and variation  
(d) None of the above  
[Ans. (c) Heredity and variation]
- Mendel discovered the principles of heredity by studying the inheritance of \_\_\_\_\_ pairs of contrasting traits of pea plants.  
(a) 7  
(b) 8  
(c) 10  
(d) 6  
[Ans. (a) 7]
- The term \_\_\_\_\_ is the genetic constitution of an individual.  
(a) Phenotype  
(b) genotype  
(c) hybrids  
(d) alleles  
[Ans. (b) genotype]
- Gene interaction concept was introduced and explained by \_\_\_\_\_.  
(a) Hugo de Vries  
(b) Carl correns  
(c) W. Bateson  
(d) Erich  
[Ans. (c) W. Bateson]
- \_\_\_\_\_ is a condition in which the death of certain organisms occurs prematurely.  
(a) Lethality  
(b) Pleiotropy  
(c) Hypostatic  
(d) Epistasis  
[Ans. (a) Lethality]
- The activity of the enzyme SBEI is lost resulting in \_\_\_\_\_.  
(a) Round seed  
(b) Wrinkled seed  
(c) Both round and wrinkled seed  
(d) None of the above [Ans. (b) Wrinkled seed]

- A self fertilizing trihybrid plant forms 8 different gametes and \_\_\_\_\_ different zygotes.  
(a) 64  
(b) 60  
(c) 58  
(d) 46  
[Ans. (a) 64]

#### 10. SBEI stands for

- Starch Based Enzyme
- Starch Bound Enzyme
- Starch Branching Enzyme
- Starch Bilayer Enzyme

[Ans. (c) Starch Branching Enzyme]

#### 11. $RRyy$ is \_\_\_\_\_

- Dominant
- Recessive
- Homozygous
- Heterozygous

[Ans. (c) Homozygous]

#### 12. The gene for tall pea plant is related with \_\_\_\_\_

- apical dominance
- gibberellins
- Auxins
- Dwarfism

[Ans. (b) gibberellins]

#### 13. Incomplete dominance was reported in \_\_\_\_\_

- Mirabilis
- Wheat
- Tobacco
- Cucurbita

[Ans. (a) Mirabilis]

#### 14. In the ratio 12 : 3 : 1 in summer squash for fruit colour, 12 stands for

- yellow fruits
- green fruits
- white fruits
- none on the above

[Ans. (c) white fruits]

#### 15. The ratio \_\_\_\_\_ is seen in inhibitory gene interaction.

- 9 : 7
- 9 : 3 : 4
- 13 : 3
- 9 : 6 : 1

[Ans. (c) 13 : 3]

#### II. MATCH THE FOLLOWING :

1.	A	Intra-genic	(i)	Non-allelic interaction
	B	Inter-genic	(ii)	Allelic interaction
	C	Chloroplast inheritance	(iii)	Extra nuclear inheritance
	D	Cytoplasmic inheritance	(iv)	<i>Mirabilis jalapa</i>



- |     | A  | B   | C   | D   |
|-----|----|-----|-----|-----|
| (a) | ii | i   | iv  | iii |
| (b) | ii | iii | iv  | i   |
| (c) | i  | ii  | iii | iv  |
| (d) | i  | ii  | iv  | iii |

[Ans. (a) A – ii, B – i, C – iv, D – iii]

2.	A	Male Sterility	(i)	<i>Hieracium pilosella</i>
	B	Atavism	(ii)	Pearl maize
	C	Pleiotropy	(iii)	<i>Antirrhinum Sp</i>
	D	Snapdragon	(iv)	Sickle cell anemia

- |     | A  | B   | C   | D   |
|-----|----|-----|-----|-----|
| (a) | ii | iii | iv  | i   |
| (b) | ii | i   | iv  | iii |
| (c) | i  | ii  | iii | iv  |
| (d) | i  | ii  | iv  | iii |

[Ans. (b) A – ii, B – i, C – iv, D – iii]

3.	A	Genetics	(i)	Gregor Johann Mendel
	B	Father of Genetics	(ii)	No anthocyanin
	C	Pea with white flowers	(iii)	Gene A
	D	Pea with purple flower	(iv)	W. Bateson

- |     | A   | B  | C   | D   |
|-----|-----|----|-----|-----|
| (a) | i   | iv | ii  | iii |
| (b) | iii | iv | ii  | i   |
| (c) | ii  | i  | iii | i   |
| (d) | iv  | i  | ii  | iii |

[Ans. (d) A – iv, B – i, C – ii, D – iii]

4.	A	H. Nilsson	(i)	<i>Mirabilis jalapa</i>
	B	Incomplete dominance	(ii)	ABO blood grouping
	C	Codominance	(iii)	Masks the phenotypic expression
	D	Epistatic	(iv)	Kernel colour

- |     | A   | B  | C   | D   |
|-----|-----|----|-----|-----|
| (a) | i   | iv | ii  | iii |
| (b) | iii | iv | ii  | i   |
| (c) | ii  | i  | iii | i   |
| (d) | iv  | i  | ii  | iii |

[Ans. (d) A – iv, B – i, C – ii, D – iii]

5.	A	Factor hypothesis	(i)	E. Baur
	B	Lethal genes	(ii)	Cytoplasmic male sterility
	C	Polygenic inheritance	(iii)	Bateson
	D	Mitochondrial inheritance	(iv)	Wheat kernel

- |     | A   | B  | C   | D   |
|-----|-----|----|-----|-----|
| (a) | i   | iv | ii  | iii |
| (b) | iii | i  | iv  | ii  |
| (c) | ii  | i  | iii | i   |
| (d) | iv  | i  | ii  | iii |

[Ans. (b) A – iii, B – i, C – iv, D – ii]

### III. CHOOSE THE CORRECT STATEMENTS:

#### 1. "Monohybrid Cross"

- Monohybrid inheritance is the inheritance of a single character.
  - It involves the inheritance of two alleles of a single gene.
  - It involves individuals differing in two characters.
  - It is the inheritance of two separate genes.
- (a) I, II and III (b) I and II  
(c) I, II and IV (d) II, III and IV

[Ans. (b) I and II]

#### 2. "Discontinuous Variation"

- The characteristics are controlled by one or two major genes.
  - They have allelic form.
  - Variations are genetically determined by inheritance factors.
  - Also known as quantitative inheritance.
- (a) I and III (b) II and III  
(c) I, II and IV (d) II, III and IV

[Ans. (b) II and III]

#### 3. "Trihybrid Cross"

- Cross between homozygous parents that differ in three pairs of contrasting characters.
- It forms 8 different gametes and 64 different zygotes.
- Single phenotype is controlled by more than one set of genes.
- It demonstrates the Mendel's laws are applicable to the inheritance of multiple traits.

- (a) I and III (b) I and II  
(c) I, II and IV (d) II, III and IV

[Ans. (c) I, II and IV]

- Discontinuous variation is also called quantitative inheritance.
- Continuous variation is also called qualitative inheritance.



- (III) Variation is the raw material for evolution.  
(IV) Variation provides genetic material for natural selection.

- (a) I and III (b) III and IV  
(c) I, II and III (d) II, III and IV

[Ans. (b) III and IV]

#### IV. CHOOSE THE INCORRECT STATEMENTS:

##### 1. "Polygenic inheritance"

- (a) Occurs when one characteristic is controlled by two or more genes.  
(b) Group of genes determine a characteristic of an organism.  
(c) Gene interaction with two alleles.  
(d) It was demonstrated by H. Nilsson-Ehle.

[Ans. (c) Gene interaction with two alleles.]

- ##### 2.
- (a) Chloroplast acts as inheritance vector.  
(b) Mitochondrion acts as inheritance vector.  
(c) Normal cytoplasm is male fertile.  
(d) Aberrant cytoplasm is female fertile.

[Ans. (d) Aberrant cytoplasm is female fertile]

- ##### 3.
- (a) Mendel's monohybrid ratio is 9 : 3 : 3 : 1  
(b) Reciprocal differences found in *Mirabilis jalapa*.  
(c) Rf genes are required to restore fertility in pearl maize.  
(d) Test cross determines the genotype of an individual.

[Ans. (a) Mendel's monohybrid ratio is 9 : 3 : 3 : 1]

#### V. ASSERTION AND REASON:

##### Direction:

- (a) Assertion is true and Reason is correct explanation of Assertion.  
(b) Assertion and Reason is true but Reason is not correct explanation of Assertion.  
(c) Assertion is true and Reason is false.  
(d) Both Assertion and Reason are false.

- ##### 1. Assertion (A) : Genetics is described as a science which deals with heredity.

**Reason (R) : Heredity is the transmission of characters from parents to offsprings.**

[Ans. (a) Assertion is true and Reason is correct explanation of Assertion.]

- ##### 2. Assertion (A) : Variations help the individuals to adapt themselves to the changing environment.

**Reason (R) : It provides the genetic material for natural selection.**

[Ans. (a) Assertion is true and Reason is correct explanation of Assertion.]

- ##### 3. Assertion (A) : Monohybrid inheritance is the inheritance of a single character.

**Reason (R) : It involves the inheritance of single allele of a single gene.**

[Ans. (c) Assertion is true and Reason is false.]

#### VI. CHOOSE THE CORRECT PAIR :

- ##### 1.
- |                          |                   |
|--------------------------|-------------------|
| (a) Homozygous recessive | - Tall pea plant  |
| (b) Homozygous dominant  | - Dwarf pea plant |
| (c) Law of Dominance     | - Discrete units  |
| (d) Law of Segregation   | - Hybrid gametes  |

[Ans. (c) Law of Dominance – Discrete units]

- ##### 2.
- |                          |                  |
|--------------------------|------------------|
| (a) Recessive back cross | - Dihybrid cross |
| (b) Dihybrid ratio       | - 9 : 3 : 3 : 1  |
| (c) Dihybrid Cross       | - Snapdragon     |
| (d) Monohybrid Cross     | - Sex dependent  |

[Ans. (b) Dihybrid ratio – 9 : 3 : 3 : 1]

#### VII. CHOOSE THE INCORRECT PAIR:

- ##### 1.
- |                      |                         |
|----------------------|-------------------------|
| (a) Codominance      | - 1 : 2 : 1             |
| (b) Snapdragon       | - <i>Antirrhinum Sp</i> |
| (c) Punnett's Square | - Carl Correns          |
| (d) Hugo de Vries    | - Mendel's experiment   |

[Ans. (c) Punnett's Square – Carl Correns]

- ##### 2.
- |                             |                            |
|-----------------------------|----------------------------|
| (a) Continuous variation    | - Quantitative inheritance |
| (b) Discontinuous variation | - Qualitative inheritance  |
| (c) Removing Anthers        | - Emasculation             |
| (d) Pea Gene A              | - Pea with white flowers   |

[Ans. (d) Pea Gene A – Pea with white flowers]

- ##### 3.
- |                           |                     |
|---------------------------|---------------------|
| (a) Gene interaction      | - W. Bateson        |
| (b) Codominance           | - Electrophoresis   |
| (c) Polygenic inheritance | - Hugo de Vries     |
| (d) Lethality             | - Death of genotype |

[Ans. (c) Polygenic inheritance – Hugo de Vries]





## Unit Test

[Time : 1 hr]

[Marks: 25]

**I. CHOOSE THE CORRECT ANSWER.  $10 \times 1 = 10$**

**1. Deals with the structure and function of a gene.**

- (a) Molecular Genetics
- (b) Population Genetics
- (c) Classical Genetics
- (d) Quantitative Genetics

**2. Select the correct statements from the ones given below with respect to dihybrid cross**

- (a) Tightly linked genes on the same chromosomes show very few combinations.
- (b) Tightly linked genes on the same chromosomes show higher combinations.
- (c) Genes far apart on the same chromosomes show very few recombinations
- (d) Genes loosely linked on the same chromosome show similar recombination as the tightly linked ones

**3. In a test cross involving F1 dihybrid flies, more parental type offspring were produced than the recombination type off spring. This indicates**

- (a) The two genes are located on two different chromosomes.
- (b) Chromosomes are failed to separate during meiosis.
- (c) The two genes are linked and present on the same chromosome.
- (d) Both of the characters are controlled by more than one gene.

**4. Choose correct statement(s) about "Monohybrid Cross".**

- (I) Monohybrid inheritance is the inheritance of a single character.
- (II) It involves the inheritance of two alleles of a single gene.
- (III) It involves individuals differing in two characters.
- (IV) It is the inheritance of two separate genes.
- (a) I, II and III only      (b) I and II only
- (c) I, II and IV only      (d) II, III and IV only

**5. Choose incorrect statement(s).**

- (a) Chloroplast acts as inheritance vector.
- (b) Mitochondrion acts as inheritance vector.
- (c) Normal cytoplasm is male fertile.
- (d) Aberrant cytoplasm is female fertile.

**6. Answer in one word:**

Name the term used by Mendel to denote genes.

**7. Assertion (A) : Monohybrid inheritance is the inheritance of a single character.**

**Reason (R) : It involves the inheritance of single allele of a single gene.**

- (a) Both assertion and reason are true. But reason is correct explanation of assertion.
- (b) Assertion is false but reason is true.
- (c) Both assertion and reason are true.
- (d) Assertion is true but reason is false.

**8. Match the following :**

A	Male Sterility	(i)	<i>Hieracium pilosella</i>
B	Atavism	(ii)	Pearl maize
C	Pleiotropy	(iii)	<i>Antirrhinum Sp</i>
D	Snapdragon	(iv)	Sickle cell anemia

- |     |    |     |     |     |
|-----|----|-----|-----|-----|
|     | A  | B   | C   | D   |
| (a) | ii | iii | iv  | i   |
| (b) | ii | i   | iv  | iii |
| (c) | i  | ii  | iii | iv  |
| (d) | i  | ii  | iv  | iii |

**9. \_\_\_\_\_ is used to identify whether an individual is homozygous or heterozygous for dominant character.**

- (a) Back Cross      (b) Test Cross
- (c) Dihybrid Cross      (d) Reciprocal Cross

**10. Choose the incorrect pair.**

- (a) Gene interaction - W. Bateson
- (b) Codominance - Electrophoresis
- (c) Polygenic inheritance - Hugo de Vries
- (d) Lethality - Death of genotype

**II. VERY SHORT ANSWER  $2 \times 2 = 4$**

- 1.** What is meant by true breeding or purebreeding lines / strain?
- 2.** Define alleles.

**III. SHORT ANSWER  $2 \times 3 = 6$**

- 1.** Draw the flowchart of different types of gene interactions.
- 2.** What are the reasons for Mendel's successes in his breeding experiments?

**IV. LONG ANSWER  $1 \times 5 = 5$**

- 1.** Write a note on incomplete dominance with an example.





- 14.** \_\_\_\_\_ is required for transcription  
(a) TATA box (b) DNA Polymerase  
(c) Okazaki fragments (d) All the above **[Ans. (a) TATA box]**
- 15.** \_\_\_\_\_ discovered that crossing over is completely absent in some species of male *Drosophila*.  
(a) Morgan (b) Bridges  
(c) Bateson (d) Reginald **[Ans. (b) Bridges]**
- 16.** Jumping genes was reported in \_\_\_\_\_.  
(a) *Neurospora* (b) *Drosophila*  
(c) Polymerase (d) Maize **[Ans. (d) Maize]**
- 17.** \_\_\_\_\_ has been used in space research.  
(a) Maize (b) *Arabidopsis*  
(c) *Drosophila* (d) Pea **[Ans. (b) Arabidopsis]**
- 18.** A mutation which reduces normal function is called \_\_\_\_\_ mutation  
(a) null (b) ectopic  
(c) Hypermorphic (d) Hypomorphic **[Ans. (d) Hypomorphic]**
- 19.** \_\_\_\_\_ is not a mutation involving nucleotide substitution.  
(a) Insertion (b) Missense  
(c) Transition (d) Deletion **[Ans. (b) Missense]**
- 20.** Roux postulated that \_\_\_\_\_ of a cell are responsible for transferring heredity.  
(a) chromosomes (b) allele  
(c) chromophore (d) gamete **[Ans. (a) chromosomes]**
- 21.** The number of linkage groups in maize is \_\_\_\_\_.  
(a) 15 (b) 20  
(c) 25 (d) 10 **[Ans. (d) 10]**
- 22.** Crossing over occurs during \_\_\_\_\_ stage of meiosis.  
(a) pachytene (b) tetrad  
(c) metaphase-I (d) metaphase-II **[Ans. (a) pachytene]**
- 23.** One map unit in a genetic map is called \_\_\_\_\_.  
(a) centimorgan (b) centimeter  
(c) millimeter (d) meter **[Ans. (a) centimorgan]**
- 24.** Self sterility caused by multiple alleles has been reported in \_\_\_\_\_.  
(a) pea (b) *Drosophila*  
(c) maize (d) *Nicotiana* **[Ans. (d) Nicotiana]**

- 25.** A plant in which environment plays a role in sexual determination is \_\_\_\_\_.  
(a) pea (b) maize  
(c) *Equisetum* (d) *sphaerocarpos* **[Ans. (c) Equisetum]**
- 26.** Sex determination in papaya is controlled by \_\_\_\_\_ alleles.  
(a) two (b) three (c) four (d) five **[Ans. (b) three]**

## II. MATCH THE FOLLOWING :

1.	A	Transposons	(i)	<i>Drosophila</i>
	B	Complete linkage	(ii)	Environment
	C	Tetrad	(iii)	Maize
	D	<i>Equisetum</i>	(iv)	Crossing over

	A	B	C	D
(a)	ii	iii	iv	i
(b)	i	iii	ii	iv
(c)	iii	i	iv	ii
(d)	i	iv	ii	iii

**[Ans. (c) A - iii, B - i, C - iv, D - ii]**

2.	A	Charged tRNA	(i)	Promoter
	B	RNA polymerase II	(ii)	Paracentric
	C	Hogness box	(iii)	ATP
	D	Inversion	(iv)	hnRNA

	A	B	C	D
(a)	iii	iv	i	ii
(b)	i	ii	iii	iv
(c)	i	iv	iii	ii
(d)	ii	iii	iv	i

**[Ans. (a) A - iii, B - iv, C - i, D - ii]**

3.	A	Doob grass	(i)	<i>Datura</i>
	B	Double Monosomy	(ii)	Hexaploid
	C	Trisomy	(iii)	Maize
	D	Triticale	(iv)	Autotriploid

	A	B	C	D
(a)	ii	iii	iv	i
(b)	i	iii	ii	iv
(c)	iii	i	iv	ii
(d)	iv	iii	i	ii

**[Ans. (d) A - iv, B - iii, C - i, D - ii]**



### III. IDENTIFY THE CORRECT STATEMENTS:

1. (I) Incomplete linkage 1:1:1:1 ratio is not obtained in test cross.  
(II) Synaptonemal complex prevents crossing over in *Drosophila*.  
(III) Crossing over is the reason for incomplete linkage.  
(IV) The horizontal cut will not create recombinants according to Robin Holliday.  
(a) I, II and IV (b) I and IV  
(c) III and IV (d) I, III and IV

**[Ans. (d) I, III and IV]**

2. (I) In papaya, sex chromosomes look like autosomes.  
(II) Aneuploidy is represented as  $4n$   
(III) Herbert Taylor proved the process of transcription experimentally.  
(IV) Caffeine is a comutagen  
(a) I, II and IV (b) I and IV  
(c) III and IV (d) I, II and III

**[Ans. (b) I and IV]**

3. (I) Ribosomes are molecular machines helping in transcription  
(II) Polyadenylation occurs in pre mRNA  
(III) Introns are non amino acid coding sequences  
(IV) Silencer sequences are DNA sequences that inhibit transcription.  
(a) I and III (b) I and IV  
(c) II, III and IV (d) II and III

**[Ans. (c) II, III and IV]**

4. (I) Gibberellins play a role in sex determination in maize.  
(II) Multiple alleles determine self sterility in *Nicotiana*.  
(III) Crossing over leads to non-separation of linked genes.  
(IV) In incomplete linkage, crossing over is observed.  
(a) I and IV (b) II and III  
(c) I, II and IV (d) II, III and IV

**[Ans. (c) I, II and IV]**

5. (I) Experimental evidence of transcription was given by Herbert Taylor  
(II) Inversion was first reported in *drosophila*.

- (III) Sharbati Sonora, is the work of Dr.M.S.Swaminathan  
(IV) Increase in temperature reduces the rate of mutation.

- (a) I and IV (b) II and III  
(c) I, III and IV (d) III and IV

**[Ans. (b) II and III]**

### IV. CHOOSE THE CORRECT PAIR:

1. (a) Morgan - Chromosome theory  
(b) Montgomery - Pairing of chromosome  
(c) Boveri - Linkage  
(d) Bridges - Lathyrus

**[Ans. (b) Montgomery - Pairing of chromosome]**

2. (a) Tetrad - Zygotene  
(b) Synapsis - Leptotene  
(c) Crossing over - Pachytene  
(d) Terminalisation - Metaphase

**[Ans. (c) Crossing over - Pachytene]**

3. (a) Single cross - Genetic map  
(b) Allen - Nicotiana - sex determination  
(c) Recombination - Robin Holliday  
(d) Papaya -  $n = 17$

**[Ans. (c) Recombination - Robin Holliday]**

4. (a) Knock out - Loss of gene  
(b) Transition -  $A \rightarrow T$   
(c) Transversion -  $A \rightarrow G$   
(d) Missense mutation - Change in amino acid

**[Ans. (d) Missense mutation - Change in amino acid]**

### V. CHOOSE THE INCORRECT PAIR :

1. (a) Caffeine - Comutagen  
(b) UV rays - mutagen  
(c) Muller - *Drosophila* mutations  
(d) Monosomy -  $2n + 1$

**[Ans. (d) Monosomy -  $2n + 1$ ]**

2. (a) Trisomy - Datura  
(b) Triploid - Banana  
(c) Triticale - High valine  
(d) Translocation - non-homologous chromosome

**[Ans. (c) Triticale - High valine]**



3. (a) Okazaki - 5' → 3' fragments  
(b) Helicase - hydrogen bonds  
(c) hnRNA - mRNA  
(d) Splicing - removal of defective gene

**[Ans. (c) hnRNA - mRNA]**

4. (a) Translocation - tRNA  
(b) *p*-site - Ribosome  
(c) polysome - protein synthesis  
(d) RNA editing - chloroplast

**[Ans. (a) Translocation - tRNA]**

5. (a) *Arabidopsis* - space  
(b) Alternative Splicing - stress response  
(c) mRNA - codons  
(d) AUG - stop codon

**[Ans. (d) AUG - stop codon]**

## VI. ASSERTION AND REASON:

**Direction:**

- (a) Assertion is true and Reason is correct explanation of Assertion.  
(b) Assertion and Reason is true but Reason is not correct explanation of Assertion.  
(c) Assertion is true and Reason is false.  
(d) Both Assertion and Reason are false.

1. **Assertion (A) :** DNA polymerase alpha synthesizes primers.

**Reason (R) :** DNA polymerase requires a free 3' OH to initiate DNA synthesis.

**[Ans.(a) Assertion is true and Reason is correct explanation of Assertion]**

2. **Assertion (A) :** In radiography experiment cells are arrested at metaphase stage.

**Reason (R) :** The separation of daughter chromosomes is clearly seen by spindle formation.

**[Ans.(c) Assertion is true and Reason is false]**

3. **Assertion (A) :** Capping protect the DNA from degradation.

**Reason (R) :** Capping is followed by Tailing where 3' end of tRNA is cleaved.

**[Ans.(d) Both Assertion and Reason are false]**

4. **Assertion (A) :** Release factors recognize the initiation codons.

**Reason (R) :** UAA is the initiation codon.

**[Ans.(d) Both Assertion and Reason are false]**

### ANSWER IN ONE WORD\*

- Who proposed the chromosome theory of inheritance? **[Ans. Sutton and Boveri]**
- Who demonstrated sex linkage for the first time? **[Ans. Thomas Hunt Morgan (*Drosophila*)]**
- Who reported linkage? **[Ans. William Bateson and Reginald C.]**
- The other name for unlinked genes is \_\_\_\_\_. **[Ans. Synteny]**
- Who reported incomplete linkage? **[Ans. Hutchinson]**
- In which plant was incomplete linkage reported for the first time? **[Ans. Maize]**
- Who coined the term crossing over? **[Ans. Morgan]**
- Pairing of homologous chromosomes is known as \_\_\_\_\_. **[Ans. synapsis]**
- When does synapsis occur in a cell? **[Ans. Meiotic - prophase I (zygotene)]**
- In which stage does crossing over occur in a cell? **[Ans. Pachytene (meiosis prophase I)]**
- X-shaped structures formed during crossing over is \_\_\_\_\_. **[Ans. Chiasmata]**
- Filaments which facilitated synapsis and chiasma formation in crossing over is \_\_\_\_\_. **[Ans. Synaptonemal Complex]**
- Unit of distance in a genetic map is \_\_\_\_\_. **[Ans. map unit]**
- The other name for map unit is \_\_\_\_\_. **[Ans. centimorgan]**
- Who proposed mutation theory? **[Ans. Hugo de Vries]**
- Who coined the term mutation? **[Ans. Hugo de Vries]**
- In which plant was mutation first reported? **[Ans. *Oenothera lamarckiana*]**
- Agents which cause mutation is \_\_\_\_\_. **[Ans. mutagens]**
- Mutations which reduces normal functioning is \_\_\_\_\_. **[Ans. Hypomorphic (leaky)]**



20. If there is no change in the amino acid encoded, the type of mutation is called \_\_\_\_\_.  
[Ans. Silent mutation]
21. \_\_\_\_\_ is a mutant wheat variety developed by irradiation.  
[Ans. Sharbati Sonora]
22. Who is Father of Indian green revolution?  
[Ans. Dr. M.S. Swaminathan]
23. Example of a chemical mutagen.  
[Ans. Methyl methane sulphonate]
24. Substance which lack their own mutagenic properties but enhance the effects of known mutagens are \_\_\_\_\_.  
[Ans. comutagens]
25. The other name for numerical chromosomal aberration is \_\_\_\_\_.  
[Ans. ploidy]
26. Ploidy involving individual chromosomes within a diploid set.  
[Ans. Aneuploidy]
27. Ploidy involving entire sets of chromosomes is \_\_\_\_\_.  
[Ans. Euploidy]
28. Addition of single chromosome to a diploid set.  
[Ans. tetrasomy]
29. Addition of two individual pairs of chromosomes to a diploid set.  
[Ans. Double tetrasomy]
30. Loss of a single chromosome from a diploid set.  
[Ans. monosomy]
31. Loss of a pair of homologous chromosome from diploid set.  
[Ans. Nullisomy]
32. \_\_\_\_\_ is an organism possessing more than two basic sets of chromosomes.  
[Ans. Polyploid]
33. A plant which is a natural autotriploid.  
[Ans. *Cyanodon dactylon*]
34. An example of an allopolyploid.  
[Ans. *Rhaphano brassica*]
35. The first man made cereal is \_\_\_\_\_.  
[Ans. Triticale]
36. \_\_\_\_\_ is an amino acid which is abundant in Rye.  
[Ans. Lysine]
37. \_\_\_\_\_ is an alkaloid which can induce polyploidy.  
[Ans. Colchicine]
38. Enzyme which initiates DNA replication.  
[Ans. DNA polymerase  $\alpha$ ]
39. An enzyme which removes supercoiling from replication fork during replication.  
[Ans. Topoisomerase]
40. Short pieces of DNA synthesized on the lagging strand is \_\_\_\_\_.  
[Ans. Okazaki fragments]
41. Coding sequences of mRNA is \_\_\_\_\_.  
[Ans. Exons]
42. \_\_\_\_\_ is non-coding sequences of mRNA.  
[Ans. Introns]
43. Process of removal of introns and knitting of exons in mRNA.  
[Ans. Splicing]
44. Sequence of bases on tRNA which are complementary to codon of mRNA.  
[Ans. Anticodons]
45. A cluster of Ribosomes linked together by mRNA is \_\_\_\_\_.  
[Ans. polysomes / polyribosomes]
46. Mobile genetic elements. [Ans. Transposons]
47. Who coined the word jumping genes?  
[Ans. Barbara McClintock]
48. A plant which successfully completed its life cycle in space.  
[Ans. *Arabidopsis*]
49. Who first demonstrated sex linkage?  
[Ans. Morgan]
50. Genes which have lost their ability to make proteins. [Ans. Pseudogenes / Fossil genes]
51. In which plant did Bateson and Punnett demonstrate linkage?  
[Ans. *Lathyrus Odoratus*]
52. Who reported absence of crossing over in some *Drosophila* species?  
[Ans. C.B. Bridges]
53. Who proposed widely accepted model of DNA recombination?  
[Ans. Robin Holliday]
54. Another name for synonymous mutations  
[Ans. Silent mutations]
55. A mutant variety of castor produced to bring in early maturity.  
[Ans. *Castor Aruna*]
56. Compounds which enhance mutagenic effects of mutagens.  
[Ans. Comutagens]
57. Who used X-rays to induce mutations in *Drosophila*?  
[Ans. H.J. Muller]
58. What kind of plants are produced by selfing of monosomics?  
[Ans. Nullisomics]
59. Who produced *Raphano brassica*?  
[Ans. G.D. Karpachenko]
60. In which organism, 400 origins of replication can be found?  
[Ans. Yeast]
61. Which bonds do Helicases break to unwind DNA?  
[Ans. Hydrogen bonds]

## Unit Test

[Time : 1 hr]

[Marks: 25]

**I. CHOOSE THE CORRECT ANSWER.  $10 \times 1 = 10$**

- 1. Due to incomplete linkage in maize, the ratio of parental and recombinants are**

(a) 50:50 (b) 7:1:1:7  
(c) 96.4: 3.6 (d) 1:7:7:1

- 2. Assertion ((a) : Gamma rays are generally use to induce mutation in wheat varieties.**

**Reason (R) : Because they carry lower energy to non-ionize electrons from atom.**

(a) A is correct. R is correct explanation of A  
(b) A is correct. R is not correct explanation of A  
(c) A is correct. R is wrong explanation of A  
(d) A and R are wrong.

- 3. Match the following.**

A	Transposons	(i)	<i>Drosophila</i>
B	Complete linkage	(ii)	Environment
C	Tetrad	(iii)	Maize
D	Equisetum	(iv)	Crossing over

A      B      C      D  
(a) ii      iii      iv      i  
(b) i      iii      ii      iv  
(c) iii      i      iv      ii  
(d) i      iv      ii      iii

- 4. The number of chromosomes in a diploid cell of *Drosophila* is \_\_\_\_\_.**

(a) 6 (b) 8 (c) 10 (d) 12

- 5. Choose the correct statement(s).**

(I) Incomplete linkage 1:1:1:1 ratio is not obtained in test cross.  
(II) Synaptonemal complex prevents crossing over in *Drosophila*

(II) crossing over is the reason for incomplete linkage

(III) The horizontal cut will not create recombinants according to Robin Holliday.

(a) I, II and IV only (b) I and IV only  
(c) III and IV only (d) I, III and IV

- 6. Sharbati sonora is a mutant wheat variety got by using \_\_\_\_\_**

(a) Nitrous acid (b) X-ray  
(c) gamma ray (d) MMS

- 7. Trisomy was first reported by \_\_\_\_\_.**

(a) Morgan (b) Blackeslee  
(c) Stadler (d) De Vries

- 8. An allohexaploid contains \_\_\_\_\_.**

(a) Six different genomes  
(b) Six copies of three different genomes  
(c) Two copies of three different genomes  
(d) Six copies of one genome

- 9. If haploid number in a cell is 18. The double monosomic and trisomic number will be**

(a) 35 and 37 (b) 34 and 35  
(c) 37 and 35 (d) 17 and 19

- 10. Removal of RNA polymerase III in nucleoplasm will affect the synthesis of**

(a) rRNA (b) tRNA  
(c) hnRNA (d) mRNA

**II. VERY SHORT ANSWER  $2 \times 2 = 4$**

- 1.** What is the difference between missense and non-sense mutation?  
**2.** What is synteny?

**III. SHORT ANSWER  $2 \times 3 = 6$**

- 1.** Differentiate Exons and Introns.  
**2.** Write the significance of crossing over.

**IV. LONG ANSWER  $1 \times 5 = 5$**

- 1.** Write a note on polyploidy.





Chapter

10

UNIT X : Economic Botany

# ECONOMICALLY USEFUL PLANTS AND ENTREPRENEURIAL BOTANY

## Chapter Snapshot

### Bio-Botany

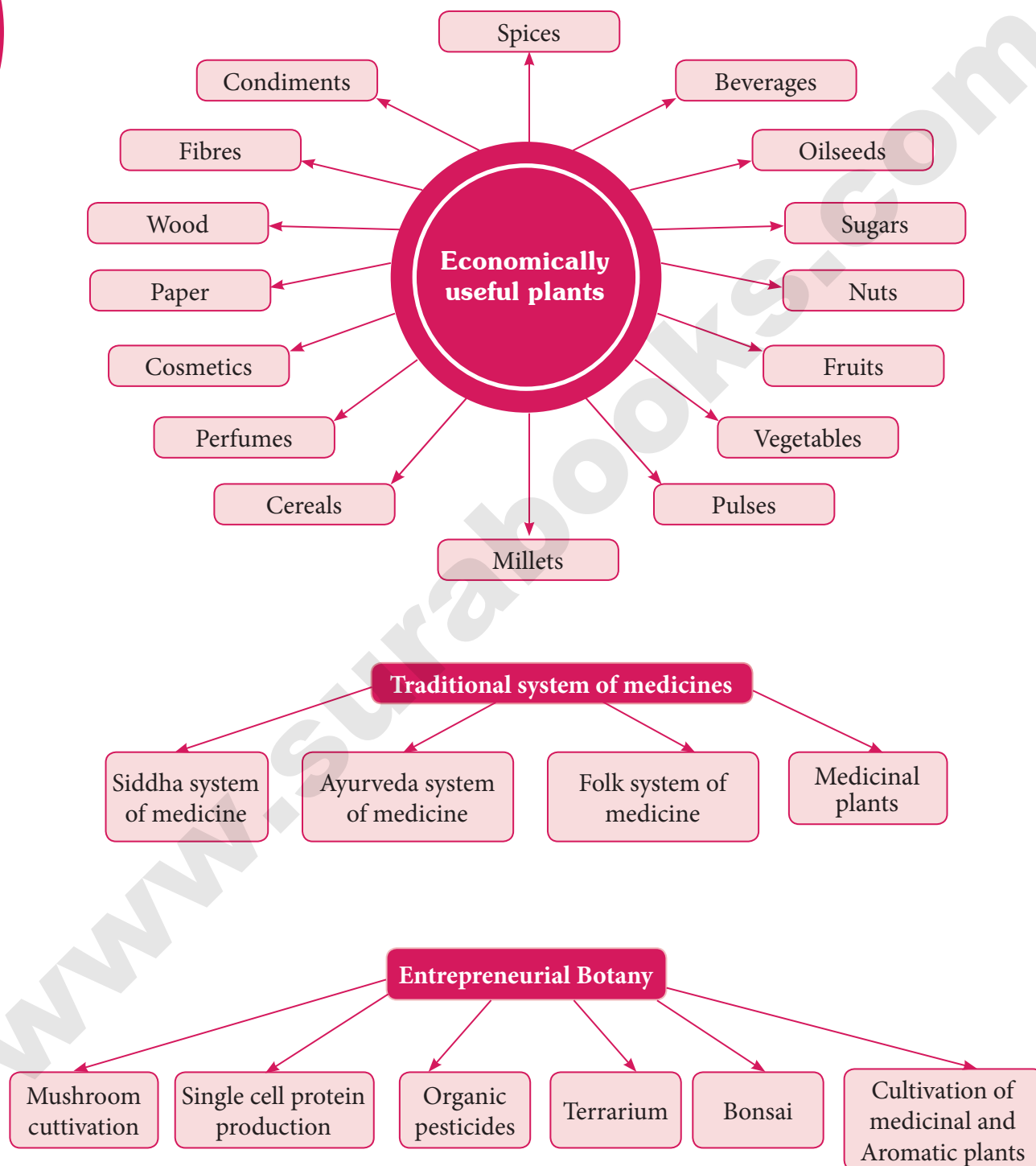
- 10.1 Food Plants
  - 10.1.1 Cereals
  - 10.1.2 Millets (Siru Thaniyangal)
  - 10.1.3 Minor Millets
  - 10.1.4 Pulses
  - 10.1.5 Vegetables
  - 10.1.6 Fruits
  - 10.1.7 Nuts
  - 10.1.8 Sugars
  - 10.1.9 Oil Seeds
  - 10.1.10 Beverages
- 10.2 Spices and Condiments
- 10.3 Fibres
- 10.4 Timber
- 10.5 Latex
- 10.6 Pulp wood
- 10.7 Dyes
- 10.8 Cosmetics
  - 10.8.1 Perfumes
- 10.9 Traditional System of Medicines
- 10.10 Medicinal Plants
- 10.11 Entrepreneurial Botany
  - 10.11.1 Organic farming

### Botany

- 10.1 Food Plants
  - 10.1.1 Cereals
  - 10.1.2 Millets (Siru Thaniyangal)
  - 10.1.3 Minor Millets
  - 10.1.4 Pulses
  - 10.1.5 Vegetables
  - 10.1.6 Fruits
  - 10.1.7 Nuts
  - 10.1.8 Sugars
  - 10.1.9 Oil Seeds
  - 10.1.10 Beverages
- 10.2 Spices and Condiments
- 10.3 Fibre
- 10.4 Timber
- 10.5 Latex
- 10.6 Pulp wood
- 10.7 Dye
- 10.8 Cosmetics
  - 10.8.1 Perfumes
- 10.9 Traditional System of Medicines
- 10.10 Medicinal Plants
- 10.11 Entrepreneurial Botany
  - 10.11.1 Mushroom cultivation
  - 10.11.2 Single Cell Protein (SCP) Production
  - 10.11.3 Seaweed Liquid Fertilizer
  - 10.11.4 Organic farming
  - 10.11.5 Terrarium
  - 10.11.6 Cultivation of Medicinal and Aromatic Plants



## Concept Map





## MUST KNOW DEFINITIONS

<b>Pseudocereal</b>	: Foods that are prepared and <b>eaten as a whole grain</b> .
<b>Millets</b>	: Variety of small seeds.
<b>Pulses</b>	: Edible seeds got from <b>fruits of Fabaceae</b> .
<b>Spices</b>	: Aromatic plant products used for cooking.
<b>Condiments</b>	: Flavouring substance added to food after cooking.
<b>Wood pulp</b>	: Wood is converted into pulp by mechanical and chemical processes.
<b>Dyes</b>	: Colouring agents are <b>called dyes</b> .
<b>Diuretic</b>	: Substance that promote urine production.
<b>Cirrhosis</b>	: A chronic liver disease typically <b>caused by alcoholism</b> or <b>hepatitis</b> .
<b>Antioxidant</b>	: A substance that scavenges free radicals.
<b>Carminative</b>	: A drug causing expulsion of gas from the stomach or bowel.
<b>Malnutrition</b>	: Deficiencies, excesses or imbalances in a person's intake of energy and /or nutrients.
<b>Spawn</b>	: Mycelium especially prepared for propagating mushrooms.
<b>Aromatic crops</b>	: Plants that produce aromatic oils.
<b>Perfumery</b>	: The art or process of making perfume.
<b>Cosmetics</b>	: Substances or products used for personal grooming.
<b>Confectionary</b>	: A place where confections / sweets are kept or made.
<b>Anti-inflammatory</b>	: The property of a substance or treatment that reduces swelling.
<b>Alzheimer's disease</b>	: A type of dementia that causes problems with memory, thinking and behavior.
<b>Ethnobiology</b>	: Ethnobiology is the study of relationships between peoples and plants.
<b>Pharmacopoeia</b>	: Is a book containing directions for the identification of compound medicines, and published by the authority of a government or a medical or pharmaceutical society.
<b>Fixative</b>	: A substance used to reduce the evaporation rate and improve stability when added to more volatile components.
<b>Antiperspirant</b>	: Products whose primary function is to inhibit perspiration / sweat.
<b>Seasoning</b>	: The processing of food with spices and condiments to enhance the flavour.

## ABBREVIATION

<b>IRRI</b>	: <b>I</b> nternational <b>R</b> ice <b>R</b> esearch <b>I</b> nstitute
<b>SFA</b>	: <b>S</b> aturated <b>F</b> atty <b>A</b> cid
<b>UFA</b>	: <b>U</b> nsaturated <b>F</b> atty <b>A</b> cid
<b>MUFA</b>	: <b>M</b> ono <b>U</b> nsaturated <b>F</b> atty <b>A</b> cid
<b>PUFA</b>	: <b>P</b> oly <b>U</b> nsaturated <b>F</b> atty <b>A</b> cid
<b>TSM</b>	: <b>T</b> raditional <b>S</b> ystems of <b>M</b> edicine
<b>USPTO</b>	: <b>U</b> nited <b>S</b> tates <b>P</b> atent and <b>T</b> rade mark <b>O</b> ffice
<b>TK</b>	: <b>T</b> raditional <b>K</b> nowledge





THC	:	trans-tetrahydrocannabinol
SCP	:	Single Cell Protein
NCB	:	Narcotics Control Bureau
NMPB	:	National Medicinal Plants Board
CIMAP	:	Central Institute of Medicinal and Aromatic Plants
HDL	:	High Density Lipids
GI	:	Geographical Indication

## EVALUATION

- Consider the following statements and choose the right option.  
i) Cereals are members of grass family.  
ii) Most of the food grains come from monocotyledon.  
(a) (i) is correct and (ii) is wrong  
(b) Both (i) and (ii) are correct  
(c) (i) is wrong and (ii) is correct  
(d) Both (i) and (ii) are wrong  
[Ans. (b) Both (i) and (ii) are correct]
- Assertion :** Vegetables are important part of healthy eating.  
**Reason :** Vegetables are succulent structures of plants with pleasant aroma and flavours.  
(a) Assertion is correct, Reason is wrong  
(b) Assertion is wrong, Reason is correct  
(c) Both are correct and reason is the correct explanation for assertion.  
(d) Both are correct and reason is not the correct explanation for assertion.  
[Ans. (a) Assertion is correct, Reason is wrong]
- Groundnut is native of** \_\_\_\_\_  
(a) Philippines (b) India  
(c) North America (d) Brazil  
[Ans. (d) Brazil]
- Statement A:** Coffee contains caffeine  
**Statement B:** Drinking coffee enhances cancer  
(a) A is correct, B is wrong  
(b) A and B – Both are correct  
(c) A is wrong, B is correct  
(d) A and B – Both are wrong  
[Ans. (a) A is correct, B is wrong]
- Tectona grandis** is coming under family \_\_\_\_\_  
[May-'22]  
(a) Lamiaceae (b) Fabaceae  
(c) Dipterocarpaceae (d) Ebenaceae  
[Ans. (a) Lamiaceae]
- Tamarindus indica** is indigenous to \_\_\_\_\_  
(a) Tropical African region  
(b) South India, Sri Lanka  
(c) South America, Greece  
(d) India alone [Ans. (a) Tropical African region]
- New world species of cotton**  
(a) *Gossypium arboreum*  
(b) *G. herbaceum* (c) Both a and b  
(d) *G. barbadense* [Ans. (d) *G. barbadense*]
- Assertion :** Turmeric fights various kinds of cancer.  
**Reason :** Curcumin is an anti-oxidant present in turmeric.  
[Aug-2021]  
(a) Assertion is correct, Reason is wrong  
(b) Assertion is wrong, Reason is correct  
(c) Both are correct  
(d) Both are wrong [Ans. (c) Both are correct]
- Find out the correctly matched pair.**  
[Govt.MQP-2019]  
(a) Rubber - *Shorea robusta*  
(b) Dye - *Lawsonia inermis*  
(c) Timber - *Cyperus papyrus*  
(d) Pulp - *Hevea brasiliensis*  
[Ans. (b) Dye - *Lawsonia inermis*]



10. Observe the following statements and pick out the right option from the following:

**Statement I** – Perfumes are manufactured from essential oils.

**Statement II** – Essential oils are formed at different parts of the plants.

- (a) Statement I is correct
- (b) Statement II is correct
- (c) Both statements are correct
- (d) Both statements are wrong

[Ans. (c) Both statements are correct]

11. Observe the following statements and pick out the right option from the following:

**Statement I** : The drug sources of Siddha include plants, animal parts, ores and minerals.

**Statement II:** Minerals are used for preparing drugs with long shelf-life. [July-'22]

- (a) Statement I is correct
- (b) Statement II is correct
- (c) Both statements are correct
- (d) Both statements are wrong

[Ans. (c) Both statements are correct]

12. The active principle trans-tetra hydrocannabinol is present in

- (a) Opium
- (b) Curcuma
- (c) Marijuana
- (d) Andrographis

[Ans. (c) Marijuana]

13. Which one of the following matches is correct?

- (a) Palmyra - Native of Brazil
- (b) Saccharun - Abundant in Kanyakumari
- (c) Steviolide - Natural sweetener
- (d) Palmyra sap - Fermented to give ethanol

[Ans. (c) Steviolide - Natural sweetener]

14. The only cereal that has originated and domesticated from the New world.

- (a) *Oryza sativa*
- (b) *Triticum aestivum*
- (c) *Triticum durum*
- (d) *Zea mays*

[Ans. (d) *Zea mays*]

15. Write the cosmetic uses of *Aloe*. [Sep-2020]

- Ans. (i)** It is used as skin tonic.
- (ii)** Due to cooling effect and moisturizing characteristics they are used in preparation of creams, lotions, shampoos, shaving creams, after shave lotions and allied products.
- (iii)** It is used in gerontological applications for rejuvenation of aging skin.

- (iv)** Products from aloe leaves have properties such as emollient, antibacterial, antioxidant, antifungal and antiseptic.

- (v)** *Aloe vera* gel is used in skin care cosmetics.

16. What is pseudo cereal? Give an example.

**Ans.** The term pseudo-cereal is used to describe foods that are prepared and eaten as a whole grain, but are botanical outliers from grasses.

**Example :** Quinoa - seed from the *Chenopodium quinoa* plant.

It is a gluten-free, whole-grain carbohydrate, as well as a whole protein.

17. Discuss which wood is better for making furniture. (or)

Write the uses of Teak Wood. [May-'22]

**Ans. Teak wood is better for making furniture.**

**Botanical name :** *Tectona grandis*

- (i)** It is one of best timbers of the world.
- (ii)** The heartwood is golden yellow to golden brown when freshly sawn, turning darker when exposed to light.
- (iii)** Durable and immune to the attack of termites and fungi.
- (iv)** The wood does not split or crack and is a carpenter friendly wood.

18. A person got irritation while applying chemical dye. What would be your suggestion for alternative?

- Ans. (i)** Henna is the best alternative natural dye.
- (ii)** An orange dye 'Henna' is obtained from the leaves and young shoots of *Lawsonia inermis*.
- (iii)** The principal colouring matter of leaves 'lacosone' is harmless and causes no irritation to the skin.
- (iv)** It is used to dye skin, hair and finger nails.

19. Name the humors that are responsible for the health of human beings. (OR)

What are the three humors for siddha medicine? [HY-2019; Aug-2021; July-'22]

- (i)** Siddha is principally based on the **Pancabuta** philosophy.
- (ii)** **Three humors** namely **Vātam**, **Pittam** and **Kapam** are responsible for the health of human beings.
- (iii)** Any disturbance in the equilibrium of these humors result in ill health.



**20. Give definitions for organic farming.**

[Mar-2020; May & July-'22]

**Ans.** Organic farming is an alternative agricultural system in which plants/crops are cultivated in natural ways by using biological inputs to maintain soil fertility and ecological balance thereby minimizing pollution and wastage.

**21. Which is called as the "King of Bitters"? Mention their medicinal importance.** [Aug-2021]

**Ans.** Nilavembu

**Botanical name :** *Andrographis paniculata*

**Family:** Acanthaceae

*Andrographis paniculata*, known as the **King of Bitters** is traditionally used in Indian systems of medicines.

**Active principle :** Andrographolides.

**Medicinal importance :** *Andrographis* is a **potent hepatoprotective** and is widely used to treat liver disorders. Concoction of *Andrographis paniculata* and eight other herbs (Nilavembu Kudineer) is effectively used to treat malaria and dengue.

**22. Differentiate bio-medicines and botanical medicines.**

**Ans.**

Bio-medicines	Botanical medicines
Medicinally useful molecules obtained from plants that are marketed as drugs are called Biomedicines.	Medicinal plants which are marketed as powders or in other modified forms are known as botanical medicines.

**23. Write the origin and area of cultivation of green gram and red gram.**

**Ans.** Green gram

**Botanical name :** *Vigna radiata*

**Origin and Area of cultivation :** Green gram is a native of India and the earliest archaeological evidences are found in the state of Maharashtra. It is cultivated in the states of Madhya Pradesh, Karnataka and Tamil Nadu.

**Red gram / Pigeon pea**

**Botanical name :** *Cajanus cajan*

**Origin and Area of cultivation :** It is the only pulse native to Southern India. It is mainly grown in the states of Maharashtra, Andhra Pradesh, Madhya Pradesh, Karnataka and Gujarat.

**24. What are millets? What are its types? Give example for each type.** [Govt.MQP-2019]

**Ans.** The term millet is applied to a variety of very small seeds originally cultivated by ancient people in Africa and Asia. They are gluten free and have less glycemic index.

**Types of Millets:**

- (a) Finger Millet – Ragi  
Botanical name : *Eleusine coracana*
- (b) Sorghum  
Botanical name : *Sorghum vulgare*

**Minor Millets :**

- (c) Foxtail Millet  
Botanical name : *Setaria italica*
- (d) Kodo Millet  
Botanical name : *Paspalum scrobiculatum*

**25. If a person drinks a cup of coffee daily it will help him for his health. Is this correct? If it is correct, list out the benefits.**

**Ans.** Drinking coffee in moderation provides the following health benefits:

- (i) Caffeine enhances release of acetylcholine in brain, which enhances efficiency.
- (ii) It can lower the incidence of fatty liver diseases, cirrhosis and cancer. It may reduce the risk of type 2 diabetes.

**26. Enumerate the uses of turmeric.**

**Ans.** Turmeric is used as a spice and also has medicinal properties.

- (i) Turmeric is the most important ancient Indian spice and used traditionally for culinary, cosmetic, dyeing and for medicinal purposes.
- (ii) It is an important constituent of curry powders.
- (iii) Turmeric is used as a colouring agent in pharmacy, confectionery and food industry. Rice coloured with turmeric (yellow) is considered sacred, which is used in ceremonies.
- (iv) It is also used for dyeing leather, fibre, paper and toys.

**Medicinal properties**

- (i) Curcumin extracted from turmeric is responsible for the yellow colour. Curcumin is a very good anti-oxidant which may help fight various kinds of cancer.



**12<sup>th</sup>  
STD.**

**INSTANT SUPPLEMENTARY EXAM - JULY 2022**

**PART - III**

**TIME ALLOWED : 3.00 Hours ]**

**BIOLOGY (WITH ANSWERS)**

**[ MAXIMUM MARKS : 70**

- Instructions:** (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.
- (2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

**PART- I**

**(BIO -BOTANY) (Marks: 35)**

**SECTION - 1**

**Note :** (i) Answer **all** the questions: **(8 × 1 = 8)**

- (ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

1. Coleorhiza is found in \_\_\_\_\_.  
(a) Paddy (b) Beans  
(c) Pea (d) Tridax
2. In \_\_\_\_\_ the single gene affects multiple traits and alters the phenotype of the organism.  
(a) Lethal genes (b) Epistatic  
(c) Pleiotropy (d) Hypostatic
3. The bacteria responsible for inducing tumours in several dicot plants are \_\_\_\_\_.  
(a) Candida utilis (b) Spirulina  
(c) Chlorella  
(d) Agrobacterium tumifaciens
4. The time duration for sterilization process by using autoclave is \_\_\_\_\_ minutes and the temperature is \_\_\_\_\_.  
(a) 10 - 30 minutes, 125°C  
(b) 15 - 30 minutes, 121°C  
(c) 15 - 20 minutes, 125°C  
(d) 10 - 20 minutes, 121°C
5. In soil, water available for plants is \_\_\_\_\_.  
(a) Gravitational water  
(b) Chemically bound water  
(c) Capillary water  
(d) Hygroscopic water

6. Depletion of which gas in the atmosphere can lead to an increased incidence of skin Cancer?  
(a) Ammonia (b) Methane  
(c) Nitrous Oxide (d) Ozone

7. \_\_\_\_\_ are a collection of method that could increase and accelerate the development of new traits in plant breeding.

- (a) NBT (b) Trichoderma  
(c) Bio Pesticide (d) Enzymes

8. Observe the following statements and pick out the correct option from the following :

**Statement I :** The drug sources of Siddha include plants, animals, Ores and minerals.

**Statement II :** Minerals are used for preparing drugs with long shelf-life.

- (a) Statement I is correct  
(b) Statement II is correct  
(c) Both statements are correct  
(d) Both Statements are incorrect

**SECTION - 2**

**Note :** Answer **any four** of the following questions.

**(4 × 2 = 8)**

9. Give the types of synapsis.
10. What is C-value?
11. Differentiate Biotope and Ecotope.
12. What is PAR?
13. What is SLF?
14. What is Bio-pest repellent?

**SECTION - 3**

**Note :** Answer **any three** of the following questions

Q.No. 19 is **compulsory**. **(3 × 3 = 9)**

15. Draw and explain Hemianatropous Ovule with an example.

16. Give the significance of ploidy.
17. What is bio-remediation? Give an example.
18. Draw and explain the thermal stratification of a pond.
19. What is Green house effect? What are the gases involved in it?

#### SECTION - 4

**Note :** Answer **all** the questions. (2 × 5 = 10)

20. (a) Give the characteristic features of Anemophilous plants.

(OR)

- (b) Explain the incomplete dominance with example.
21. (a) Explain the food web with an example. Give its significance.

(OR)

- (b) What are Artificial Seeds? Give the advantages of Artificial Seeds.



## ANSWERS

#### SECTION - 1

1. (a) Paddy
2. (c) Pleiotropy
3. (d) Agrobacterium tumifaciens
4. (b) 15 - 30 minutes, 121°C
5. (c) Capillary water
6. (d) Ozone
7. (a) NBT
8. (c) Both statements are correct

#### SECTION - 2

9. **Synapsis is of three types:**

1. Procentric synapsis
2. Proterminal synapsis
3. Random synapsis

10. Genome content of an organism is expressed in terms of number of base pairs or in terms of the content of DNA which is expressed as c-value.

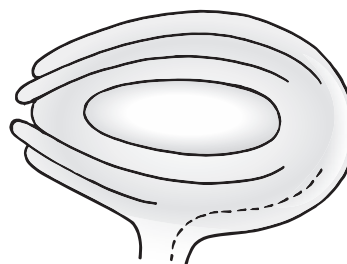
11.

	<b>Biotope</b>	<b>Ecotope</b>
1.	A specific physical space occupied by an organism (species)	A functional space occupied by an organism in the same eco-system
2.	Same habitat may be shared by many organisms (species)	A single niche is occupied by a single species
3.	The environment of any community is called biotope.	The habitat and niche of any organism is called Ecotope.

12. The amount of light available for photosynthesis of plants is called Photosynthetically Active Radiation (PAR) which is between the range of 400-700 nm wave length.
13. Seaweed liquid fertilizer (SLF) contains cytokinin, gibberellins and auxin apart from macro and micro nutrients.
14. Botanical pest repellent and insecticide made with the dried leaves of Azadirachta indica.

#### SECTION - 3

15.



**Heminanatropous**

In this, the body of the Ovule is placed transversely and at right angles to the funicle.

16. **Significance of Ploidy :**

- (i) Many polyploids are more vigorous and more adaptable than diploids.
- (ii) Many ornamental plants are autotetraploids and have larger flowers and longer flowering duration than diploids.