

**Loyola**



# EC BIO - ZOOLOGY & ZOOLOGY

**12**

(Short Version - Long Version)

This special guide is prepared on  
the basis of New Syllabus  
and Govt. Key

**Loyola**

**Publications**

Vivek Illam, No. 19, Raj Nagar, N.G.O. 'A' Colony,  
Palayamkottai, Tirunelveli - 627 007.

Ph: 0462 - 2553186

Cell : 94433 81701, 94422 69810, 90474 74696

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Authors:

**Mrs. Helen Cronans**, M.Sc., M.Ed., M.Phil.,

**Mrs. Vijayarani**, M.Sc., M.Ed., M.Phil.,

**Mr. Daniel Rajan Huberp.**, M.Sc., M.Ed.,

**Mr. Saravanan**, M.Sc., B.Ed., M.Phil.,

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# PREFACE

Dear Students

- XII - Bio Zoology book has been made EC - bearing in mind the needs and grasping power of the students.
- The subject matter given is simple, lucid and self - explanatory.

## **SPECIAL FEATURES OF THE BOOK**

- This guide has been framed based on the New 100 marks pattern
  - Theory based pattern for 70 marks.
- Additional MCQS,VSA, SA, LA questions with answer are given in each unit.**
- Every chapter has its technical terms, exhaustive one mark questions and simplified diagrams.
  - Answers include 'key points' to be taken into account during public exam paper valuation.
  - Other than textual questions enough additional questions with the right answers are given.
  - This guide is prepared in a special way that students can study for both 12th Govt. Exams and NEET Exams.
  - This guide can be used for both Bio-Zoology (Short Version) and Zoology (long version).
  - Included PTA questions and Govt. question papers with their Answer Key.
  - Use memory techniques
  - Read - study, recall and revise systematically so as to store it in the LTM (Long Term Memory) file.
  - Above all learn thoroughly with involvement.

Enclosing prayers and wishes  
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<b>Zoology</b>			
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## PART I - TEXTBOOK EVALUATION

1. In which type of parthenogenesis are only males produced? **Qty - 2019 | L.V. Aug-2022**

- a. Arrhenotoky      b. Thelytoky  
c. Amphitoky      d. Both a and b

Ans : a. Arrhenotoky

2. The mode of Sexual reproduction in bacteria is by **L.V. Aug-2021**

- a. Formation of gametes  
b. Endospore formation  
c. Conjugation  
d. Zoospore formation

Ans : c. Conjugation

3. In which mode of reproduction variations are seen **L.V. May-2022**

- a. Asexual      b. Parthenogenesis  
c. Sexual      d. Both a and b

Ans : c. Sexual

4. Assertion and reasoning questions : In each of the following questions there are two statements. One is assertion (A) and other is reasoning (R). Mark the correct answer as

- a. If both A and R are true and R is correct explanation for A.  
b. If both A and R are true but R is not the correct explanation for A.  
c. If A is true but R is false.  
d. If both A and R are false.

I. **Assertion** : In bee society, all the members are diploid except drones.

**Reason** : Drones are produced by parthenogenesis

- a b c d

Ans : a. If both A and R are true and R is correct explanation for A.

II. **Assertion** : Offsprings produced by asexual reproduction are genetically identical to the parent.

**Reason** : Asexual reproduction involves only mitosis and no meiosis.

- a b c d

Ans : a. If both A and R are true and R is correct explanation for A.

5. Name an organism where cell division is itself a mode of reproduction.

- Amoeba      ➤ Bacteria

6. Name the phenomenon where the female gamete directly develops into a new organism with an avian example.

- The phenomenon is Parthenogenesis.  
➤ Eg. Turkey

7. What is parthenogenesis ? Give two examples from animals.

**Qty - 2019 | S.V. Aug 2021 | S.V. May-2022**

- The egg develops into a complete individual without fertilization is known as parthenogenesis.  
➤ Example : Honeybees, Gall fly.

8. Which type of reproduction is effective Asexual or sexual and why? **PTA-5**

- Sexual reproduction is an effective method of reproduction.  
➤ In asexual reproduction there is no variation.  
➤ In sexual reproduction due to fusion of two gametes, variation is found.

9. The unicellular organisms which reproduce by binary fission are considered immortal. Justify?

- In Asexual reproduction single individual can able to producing off spring.  
➤ The parent cells undergo directly amitotic or mitotic division and produce young ones. So the unicellular organisms are immortal.

10. Why is the offspring formed by asexual reproduction referred as a clone?

- The offsprings formed by asexual reproduction is genetically identical to the parent.
- They can also be referred as a clone.
- Clone is the exact copy of an organism which it is developed.

11. Give reasons for the following: **PTA-2**

- a) Some organisms like honey bees are called parthenogenetic animals.
- b) A male honey bee has 16 chromosomes where as its female has 32 chromosomes.

**LV. Sep - 2020**

a) **Reason :** When the queen bees lays eggs, some eggs are laid without fertilization. From this egg develops male honey bee. So these honey bees are called parthenogenetic animals.

b) Male honey bees are formed without fertilization (ie) Egg alone.

➤ Female honey bees are formed by fertilization (ie) Fusion of male and female gamete.

➤ That is why male has 16 chromosomes in the egg

➤ The females are diploid having 32 chromosomes, 16 from male and 16 from female.

12. Differentiate between the following :

a) External and Internal Fertilization?

b) Regeneration in lizard and Planaria.

a)	External Fertilization	Internal Fertilization
	The fusion of male and female gametes takes place outside the body of female in the water medium.	The fusion of male and female gametes takes place within the body of female.
	(eg) Sponges, Fishes and amphibians.	(eg) Reptiles, aves and mammals.

b)	Regeneration in lizard	Regeneration in planaria
1	It is epimorphosis type of regeneration.	It is morphallaxis type of regeneration.
2	It is replacement of the lost part.	New planaria can develop from a small fragment of it.
3	It is restorative regeneration.	The developed planaria will be an active individual.

13. How is juvenile phase different from reproductive phase?

**Juvenile Phase :**

- It is the period of growth between the birth of the individual upto reproductive maturity.
- The juvenile stage of certain organisms  
Insects – Larva  
Cow – Calf  
Ape – Infant  
Cat – Kitten

**Reproductive Phase :**

- The period in which the organisms are able to reproduce.
- Each organism's breeding time differs.
- If they reproduce at the particular period of the year it is called seasonal breeders. (Eg.) Birds.
- If they are able to reproduce throughout their sexual maturity it is known as continuous breeders. (Eg.) Poultry and Rabbit.

## 14. Explain the different kinds of syngamy in living Organisms?

**Different kinds of syngamy**

- Autogamy-** The male and female gametes are produced by the same cell or same organism and both the gametes fuse together to form a zygote. e.g. Actinosphaerium and Paramecium.
- Exogamy-** The male and female gametes are produced by different parents and they fuse to form a zygote. e.g. Human beings – dioecious or unisexual animals.
- Hologamy-** Lower organisms, sometimes the entire mature organisms do not form gametes but they themselves behave as gametes and the fusion of such mature individuals is known as 'hologamy' e.g. Trichonympha.
- Paedogamy-** It is the sexual union of young individuals produced immediately after the division of the adult parent cell by mitosis. (eg) Actinophrys.
- Merogamy-** The fusion of small sized and morphologically different gametes (merogametes) takes place (eg) Protozoa.
- Isogamy-** The fusion of morphological and physiological identical gametes (isogametes) is called isogamy. e.g. Monocystis.
- Anisogamy-** The fusion of dissimilar gametes is called anisogamy (Gr. An-without; iso-equal; gam-marriage). Anisogamy occurs in higher animals but it is customary to use the term fertilization instead of anisogamy or syngamy. e.g. higher invertebrates and all vertebrates.

**PART II - GMQ, PTA & Govt. Exam Question & Answers****I. Choose the best answer.**

1. Human beings are unisexual animals the type of syngamy in human beings is

- autogamy
- exogamy **PTA-3**
- hologamy
- paedogamy

Ans : b) exogamy

2. In Hydra the buds develop from **PTA-4**

- ectoderm layer only
- ectoderm and endoderm layers
- ectoderm, mesoderm and endoderm layers
- ectoderm and mesoderm layers

Ans : b) ectoderm and endoderm layers

3. The primary and secondary hosts of Tape worm are respectively. **PTA-5**

- Mosquito and man
- Man and housefly
- Cattle and man
- Man and pig **Ans : d) Man and pig**

4. Paedogenetic parthenogenesis occurs in

- Aphis
- Honey bees **L.V. MAR-2020**
- Solenobia
- Gall fly **Ans : d) Gall fly**

**II. Choose the correct statement**

1. Plasmotomy means **PTA-2**

- Mononucleated parent divides into two Mononucleated individuals.
- Multinucleated parent divides into two mononucleated individuals.
- Multinucleated parent divides into many mononucleated individuals
- Multinucleated parent divides into many multinucleated daughter individuals

Ans: d) Multinucleated parent divides into many multinucleated daughter individuals

2. Which one of the following is true regarding binary fission in paramecium? **L.V. Sep-2020**

- Macronucleus divides by mitosis and micronucleus divides by amitosis
- Macronucleus divides by amitosis and the micronucleus divides by mitosis
- Macronucleus and micronucleus divide by amitosis
- Micronucleus and macronucleus divide by mitosis

Ans : b) Macronucleus divides by amitosis and the micronucleus divides by mitosis

## III. Two Mark Questions

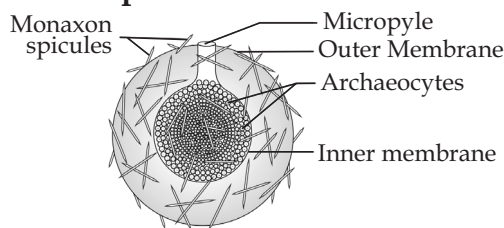
1. What is meant by autogamy? **PTA-2**

The male and female gametes are produced by the same organism and both the gametes fuse together to form a zygote. (Eg.) Paramecium.

2. Zygote is not formed during the conjugation of paramecia, but we call it as sexual reproduction. why? **PTA-2**

- It is a temporary union of the two individuals of the same species.
- During their union both individuals, called the conjugants exchange certain amount of nuclear material (DNA) and then get separated.

3. Draw the diagram of a gemmule and label the parts. **PTA-3**



Gemmule in sponges

4. What is known as Paedogamy? **Qy - 2019**

Paedogamy is the sexual union of young individuals produced immediately after the division of the adult parent cell by mitosis.

5. What is regeneration? Explain its types. **L.V. MAR-2020**

- (i) Regeneration is regrowth in the injured region. Regeneration was first studied in Hydra by Abraham Trembley in 1740.
- (ii) Regeneration is of two types, **morphallaxis** and **epimorphosis**. In morphallaxis the whole body grows from a small fragment. E.g. *Hydra* and *Planaria*.
- (iii) When *Hydra* is accidentally cut into several pieces, each piece can regenerate the lost parts and develop into a whole new individual. E.g. Star fish and wall lizard
- (iv) **Epimorphosis** is the replacement of lost body parts.

(v) It is of two types

- i) **Reparative** - Damaged tissue can be regenerated, e.g. human beings
- ii) **Restorative** - Severed body parts can develop. eg : tail of wall lizard

6. Classify fertilization based upon the place of occurrence. **L.V. Aug-2021**

- Depending upon the place where the fertilization takes place, it is of two types.
- In external fertilization, the fusion of male and female gametes takes place outside the body of female organisms in the water medium.
- e.g. sponges, fishes and amphibians.
- In internal fertilization, the fusion of male and female gametes takes place within the body of female organisms.
- e.g. reptiles, aves and mammals.

7. What is senescent phase? **L.V. May -2022**

Senescent phase begins at the end of reproductive phase when degeneration sets in the structure and functioning of the body.

## IV. Three Mark Questions

1. Meiosis cell division does not take place during the gametes formation of drone bees. Give reason. **PTA - 2**

- Drones are produced by parthenogenesis, unfertilized eggs develop into drone bees (males).
- Males have the half the number of chromosomes (haploid). Thus meiosis cell division does not take place during the gametes formation of drone bees.

2. Why do we call parthenogenesis as a special type of sexual reproduction in animals? **PTA - 4**

- Development of an egg into a complete individual without fertilization is known as parthenogenesis.
- In artificial parthenogenesis, the unfertilized egg (ovum) is induced to develop into a complete individual by physical or chemical stimuli.
- e.g., Annelid and seurchin eggs.



3. Write the differences between multiple fission and sporulation in Amoeba. **PTA - 6**

	Multiple fission	Sporulation
1	During favourable condition the encysted Amoeba divides by multiple fission and produces many minute amoebae called pseudopodiospore or amoebulae.	Favourable conditions, the parent body disintegrates and the spores are liberated, each hatching into a young amoeba.
2	The cyst wall absorbs water and breaks off liberating the young pseudopodiospore, each with a fine pseudopodia.	Nucleus break into several small fragment. Each fragment develops a nuclear membrane, become surrounded by cytoplasm and develops a spore-case around it

**PART III - ADDITIONAL QUESTIONS****I. Match the following**

- 1.
- | Column A |                             | Column B |                 |
|----------|-----------------------------|----------|-----------------|
| A        | Simple binary fission.      | i        | Euglena         |
| B        | Transverse binary fission   | ii       | Dinoflagellates |
| C        | Longitudinal binary fission | iii      | Amoeba          |
| D        | Oblique binary fission      | iv       | Paramecium      |
- A. a -(iii), b -(iv), c -(ii), d -(i)  
 B. a -(ii), b -(i), c -(iv), d -(iii)  
 C. a -(iv), b -(ii), c -(iii), d -(i)  
 D. a -(iii), b -(iv), c -(i), d -(ii)  
**Ans : D. a -(iii), b -(iv), c -(i), d -(ii)**
- 2.
- | Column A |              | Column B |              |
|----------|--------------|----------|--------------|
| A        | Arrhenotoky  | i        | Isolenobia.  |
| B        | Thelytoky    | ii       | Redia Larvae |
| C        | Amphitoky    | iii      | Honeybees    |
| D        | Paedogenesis | iv       | Aphis        |
- A. a -(ii), b -(iv), c -(iii), d -(i)  
 B. a -(iv), b -(ii), c -(i), d -(iii)  
 C. a -(iii), b -(iv), c -(ii), d -(i)  
 D. a -(iii), b -(i), c -(iv), d -(ii)  
**Ans : D. a -(iii), b -(i), c -(iv), d -(ii)**

**II. Choose the best answer.**

1. **Multiple Fission is seen in** \_\_\_\_\_  
 a) Ceratium                      b) Vorticella                      c) Paramecium                      d) Amoeba  
**Ans : b) Vorticella**
2. **Plasmotomy is observed in** \_\_\_\_\_  
 a) Giant Amoeba                      b) Ceratium                      c) Hydra                      d) Plasmodium  
**Ans : a) Giant Amoeba**
3. **Regeneration was first studied in** \_\_\_\_\_  
 a) Star fish                      b) Planaria                      c) Hydra                      d) Aurelia **Ans : c) Hydra**
4. \_\_\_\_\_ **is the temporary union of the two individuals of the same species.**  
 a) Prokaryotes                      b) Parthenogenesis                      c) Paedogenesis                      d) Conjugation  
**Ans : d) Conjugation**
5. **The fusion of morphological and physiological identical gametes is called** \_\_\_\_\_  
 a) Paedogamy                      b) Isogamy                      c) Anisogamy                      d) Merogamy  
**Ans : b) Isogamy**

### III. Choose the correct statement

- In the tapeworm the gravid proglottids are at the anterior end of the strobila.
  - The example of restorative regeneration is tail of wall lizard.
  - During favourable condition amoeba develops cyst wall and becomes inactive.
  - In external fertilization the fusion of male and female gamete takes place outside the female organism

**Ans : d. In external fertilization the fusion of male and female gamete takes place outside the female organism**

### IV. Choose the incorrect statement

- Parthenogenesis identified in the year 1745
  - Plasmotomy occurs in opalina
  - Regeneration was first studied in star fish
  - Aphis is an example of amphitoky
- In certain animals, parthenogenesis occurs naturally in their life cycle.
  - Honeybees are the example of complete parthenogenesis.
  - Redia larvae of liver fluke undergoes paedogenesis.
  - Sea urchin was induced artificially to reproduce from unfertilized eggs.

**Ans: c. Regeneration was first studied in star fish**

**Ans : b. Honeybees are the example of complete parthenogenesis.**

- Hydra develop exogenous budding, when food is less
  - In freshwater sponges the internal buds are called gemmules.
  - In tapeworm the gravid proglottids are regularly cut off by a process known as apolysis.
  - In morphallaxis the whole body grows

**Ans : a. Hydra develop exogenous budding, when food is less**

### V. Find the incorrect pair

1.	Column A	Column B
A	A sexual reproduction	Multiple fission
B	Sexual reproduction	Genetically similar
C	Amoeba	Simple binary fission
D	Macronucleus of paramecium	Amitosis

**Ans : B. Sexual reproduction - Genetically similar**

2.	Column A	Column B
A	Hydra	a Hydra vulgaris
B	Star fish	b Astria ruben
C	Giant amoeba	c Opalina
D	Tapeworm	d Taenia solium

**Ans : c. Giant amoeba - Opalina**

### VI. Choose the odd one out

- Budding
  - Sporulation
  - Anisogamy
  - Budding

**Ans: c. Anisogamy – It is involved in sexual reproduction**
- Fragmentation
  - Budding
  - Strobilation
  - Epimorphosis

**Ans: d. Epimorphosis – It is a type of regeneration**
- Juvenile phase
  - Reproductive phase
  - Senescent phase
  - Conjugation

**Ans : d. Conjugation – It is not a phase of life cycle.**

### VII. Assertion and Reasoning

- Assertion :** Artificial parthenogenesis induced parthenogenesis.  
**Reason :** It is induced biologically.

a. A and R is true                      b. Both A and R is false.  
c. A is true and R is False          d. A is false and R is true          **Ans : c. A is true and R is False**
- Assertion :** Exogamy is a type of conjugation.  
**Reason :** Male and female gametes produced by different parents.

a. A and R are true                      b. A and R are false  
c. A is true and R is false.          d. A is false and R is true          **Ans : d. A is false and R is true**
- Assertion :** Conjugation is common among ciliates.  
**Reason :** It is the temporary union of two individuals of different species.

a. Both A and R is true                b. Both A and R is false.  
c. A is true and R is false              d. A is false and R is true          **Ans : c) A is true and R is false**

### VIII. Two Mark Questions

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li> <p><b>How can we differentiate the living from nonliving things ?</b></p> <ul style="list-style-type: none"> <li>➤ The living organisms show a life cycle that involves.</li> <li>➤ Birth, growth, development, maturation, reproduction and death.</li> <li>➤ The above factors are not found in non-living things.</li> </ul> </li> <li> <p><b>Name the two major modes of reproduction.</b><br/> Asexual and sexual reproduction.</p> </li> <li> <p><b>Define sexual reproduction?</b><br/> When two parents participate in the reproductive process involving two types of gametes it is called sexual reproduction.</p> </li> <li> <p><b>What is fission?</b><br/> Fission is the division of the parent body into two or more identical daughter individuals.</p> </li> <li> <p><b>Which stage is called encystment in amoeba.</b><br/> During unfavourable condition. Amoeba develops a cyst wall around it and becomes inactive. It is called encystment.</p> </li> <li> <p><b>Define budding.</b></p> <ul style="list-style-type: none"> <li>➤ In budding the parent body produces one or more buds.</li> <li>➤ Each bud grows into a young one by detaching from the parent.</li> </ul> </li> </ol> | <ol style="list-style-type: none"> <li> <p><b>What is fragmentation ?</b><br/> The parent body breaks into fragments and each of the fragment has the potential to develop into a new individual.</p> </li> <li> <p><b>How do sea anemone asexually reproduce?</b></p> <ul style="list-style-type: none"> <li>➤ Fragmentation occurs in many genera of sea anemones.</li> <li>➤ Lobes are constricted off from pedal disc.</li> <li>➤ Each of the lobe grows mesenteries and tentacles to form a new sea anemone.</li> </ul> </li> <li> <p><b>Sponges have more power of regeneration Give reason.</b></p> <ul style="list-style-type: none"> <li>➤ Sponges when macerated and squeezed through fine silk cloth.</li> <li>➤ The cluster of cells pass through and they can regenerate new sponges.</li> </ul> </li> <li> <p><b>Why do we call fertilization process as syngamy?</b><br/> We call fertilization as syngamy becomes fusion of two haploid gametes to produce a diploid zygote.</p> </li> <li> <p><b>When do we call certain multiple fission as repeated fission ?</b></p> <ul style="list-style-type: none"> <li>➤ In multiple fission it produces four or many individuals by equal cell division.</li> <li>➤ The young ones do not separate until the process is complete then it is called repeated fission. (Eg.) Vorticella</li> </ul> </li> </ol> |
|---|--|

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EC 12th Bio-Zoology

**12. What is meant by exogamy ?**

The male and female gametes are produced by different parents and they fuse to form a zygote. (Eg.) Human – unisexual or dioecious.

2.	The individuals are represented by females only.	In Fertilized eggs develop Queen or Worker bees un fertilized eggs develop drones.
----	--	---

**13. Differentiate the following.**

1.	Exogenous Budding	Endogenous Budding
1.	When buds are formed outside the parent body it is known as exogenous budding.	Hundreds of buds are formed inside the cytoplasm and within parent body it is known as endogenous budding.
2.	(Eg.) Hydra.	(Eg.) Noctiluca.

2.	Multiple fission	Fragmentation
1.	The parent body divides into many similar daughter cells simultaneously.	The parent body breaks into fragments and each of the fragment has the potential to develop into a new individual.
2.	(Eg.) Amoeba.	(Eg.) Sea anemone

3.	Complete Parthenogenesis	Incomplete Parthenogenesis
1.	There is no biparental sexual reproduction.	Here there is both sexual reproduction and parthenogenesis occur.

**14. What is Isogamy ?**

The fusion of morphological and physiological identical gametes (isogametes) is called Isogamy. Eg. Monocystis.

**15. Define hologamy.**

In lower organisms, sometimes the entire mature organisms do not form gametes but they themselves behave as gametes and the fusion of such mature individuals is known as **hologamy**. E.g. *Trichonympha*.

**16. What is aploysis ?**

The gravid proglottids are regularly cut off either singly or in groups from the posterior end by a process called apolysis. Eg. Tapeworm

**17. What is the Reproduction system is honey bees?**

- In Honey bees, fertilized eggs develop into queen and worker bees are produced in to queen and worker bees are produced bysexual reproduction
- Unfertilized eggs develop into drones by parthenogenesis.

**18. What is Asexual Reproduction?**

- The offsprings shows “Uniparental inheritance” without any genetic variation. Eg. Protista and Bacteria.

**IX. Three Mark Questions****1. Define plasmotomy?**

- It is the division of multinucleated parent into many multinucleate daughter individuals.
- Nuclear division occurs later to maintain normal number of nuclei.
- Eg. *Pelomyxa opalina*

**2. What are Gemmules?**

- i) Internal buds called gemmules are formed which is a hard ball, consisting of an internal mass of food laden archaeocytes.
- ii) During unfavourable conditions, the sponge disintegrates, but the gemmule with stands adverse conditions.
- iii) The gemmules hatch during favourable conditions.

**3. How do tapeworm reproduce ?**

- Tapeworm asexually reproduces by fragmentation.
- In tapeworm the gravid proglottids are regularly cut off from the posterior end by a process called apolysis.
- It helps in transferring the developed embryos from the primary host (man) to the secondary host (pig)

**4. Write a short note on conjugation.**

- It is the temporary union of the two individuals of the same species.
- The conjugants exchange certain amount of nuclear material and then get separated. Eg. Paramecium

**5. Why honey bees parthenogenetic reproduction is referred as incomplete parthenogenesis.**

- In honeybees the fertilized eggs develop into queen bee and worker bee.
- The unfertilized eggs develops into drones.
- Hence both, sexual reproduction and parthenogenesis occur it is called as incomplete parthenogenesis.

**6. What are the types of syngamy found in living organisms ?**

autogamy, exogamy, hologamy, pseudogamy, merogamy, isogamy, and anisogamy.

**7. What are the modes of Reproduction?**

- Replication of DNA
- Synthesis of RNA
- Synthesis of Proteins
- Cell division
- Growth
- Fertilization
- Formation of Reproductive units

**8. What is pseudopodiospore? And its another Name?**

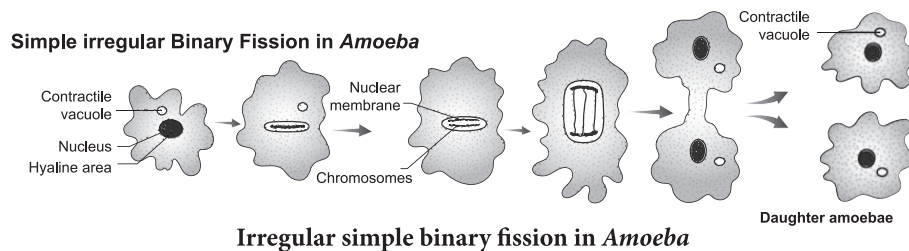
- When conditions become favourable, the encysted Amoeba divides by multiple fission and produces many minute amoebae called pseudopodiospore.
- Another Name is Amoebulae.

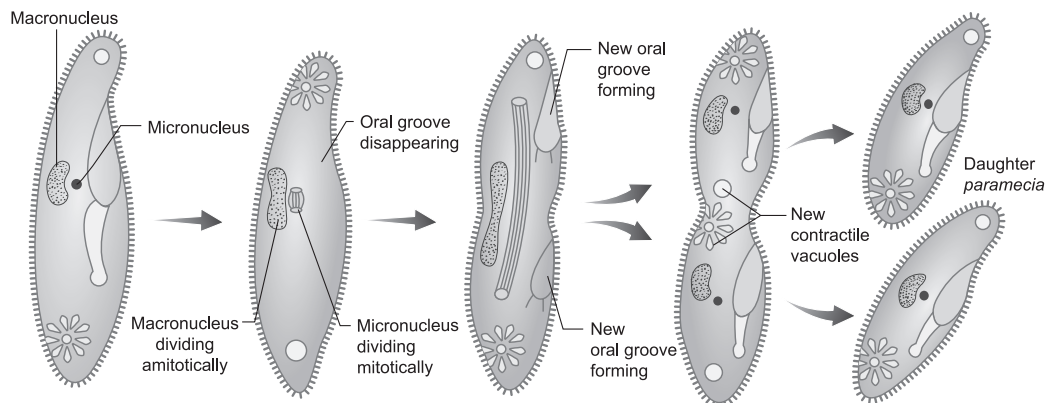
**9. How does fission occurs? And its types?**

- Fission is the division of parents body into two or more identical daughter individuals. Five types of fission are seen in animals.
- 1. Binary fission
- 2 multiple fission
- 3. Plasmotomy
- 4. Strobilation
- 5. Sporulation

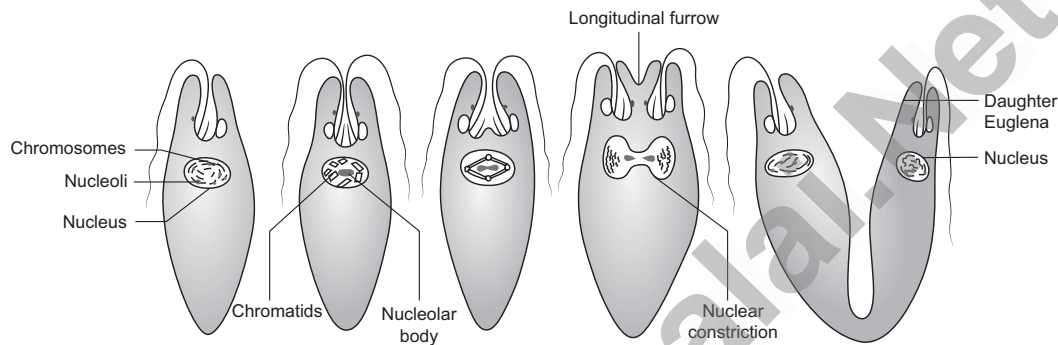
**X. Five Mark Questions****1. Enumerate the types of binary fission.**

- Division of parent into two halves and each develops into a daughter individual.
- Simple binary fission is like irregular shaped organisms. eg. Amoeba
- The plane of division is hard to observe.
- In transverse binary fission the plane of division runs along the transverse axis of the individual. (Eg.) Paramecium.





**Transverse binary fission in *Paramecium***



**Longitudinal binary fission in *Euglena***

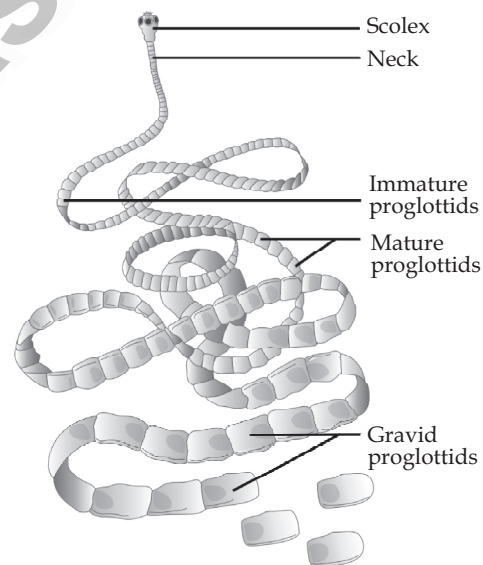
- If the plane of division is in the longitudinal axis of the organism, it is called as longitudinal binary fission. (Eg.) *Euglena*.
- The plane of division is oblique in oblique binary fission. (Eg.) *Ceratium*.

## 2. Write an essay on multiple fission.

- Multiple fission occurs during unfavourable condition (or) to increase the population in their life cycle.
- The nucleus divides into bits followed by encircling of cytoplasm to form smaller individuals.
- If the young ones do not separate until the process is complete, it is known as repeated fission. (Eg.) *Vorticella*.

## 3. Describe the fragmentation of sea anemone and tapeworm.

- Fragmentation is the process in which the parent body breaks into fragments and each of the fragment develops into a new individual.

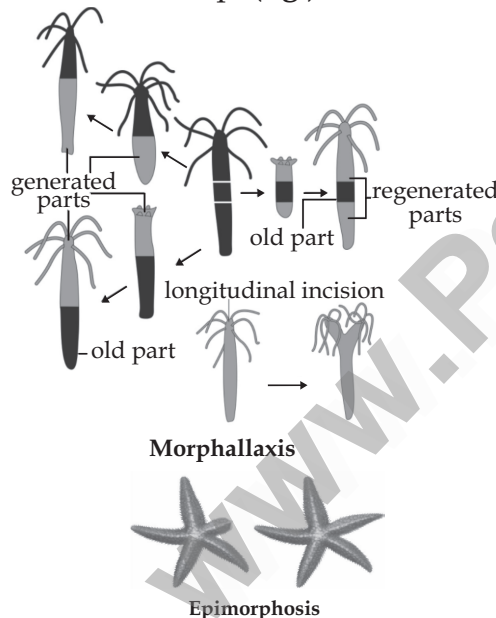


- In sea anemone the lobes are constricted off from the pedal disc and develop into a new sea anemone.
- In the tapeworm, the gravid proglottid are regularly cut off by a process called apolysis.
- The tapeworm has two host to complete its life cycle primary host is man and the secondary host is pig.

- The detached gravid proglottid helps in transferring the developed embryos from the primary host to the secondary host.

#### 4. Explain the process of regeneration and its types.

- Regeneration was first studied in hydra by Abraham Trembley in 1740.
- Regeneration is of two types morphallaxis and epimorphosis.
- In morphallaxis the whole body grows from a small fragment. (Eg.) Hydra
- When hydra is cut into several pieces, each piece can develop into a whole new individual.
- Epimorphosis is the replacement of lost body parts.
- Epimorphosis is of two types reparative and restorative regeneration.
- Damaged tissue can be regenerated by reparative regeneration. (Eg.) Human
- In restorative regeneration, the lost body parts can develop. (Eg.) Wall lizard



#### 5. Elaborate the process and types of parthenogenesis.

- Development of an egg into a complete individual without fertilization is known as parthenogenesis.
- It was first discovered by Charles Bonnet in 1745.
- It is of two types natural and artificial parthenogenesis.

- In certain animals parthenogenesis occur regularly known as natural parthenogenesis.

#### Natural parthenogenesis :

- **Arrhenotoky** – Only males are produced. Eg. honey bees
  - **Thelytoky** – Only females are produced. Eg. solenobia
  - **Amphitoky** – Egg may develop into any sex. Eg. Aphis
  - Complete parthenogenesis – It is the only form of reproduction. Eg. Some insets
  - Incomplete parthenogenesis – Here both sexual and parthenogenesis occur. Eg. Honey bees
  - Paedogenesis – The larvae produce a new generation of larvae. Eg. liver fluke
- #### Artificial parthenogenesis :
- The unfertilized egg is induced to develop into a complete individual by physical or chemical stimula. Eg. sea urchin

#### 6. Explain Budding with diagram.

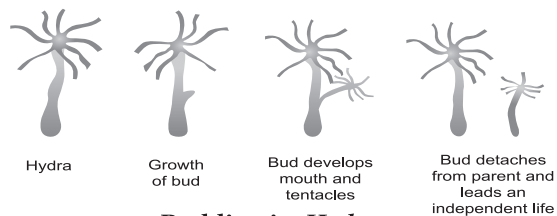
**Budding** : Parent body produces one or more buds and each bud grows into a young one. The buds separate from the parent to lead a normal life.

Eg. Sponges

**Exogenous Budding** : When buds are formed on the outer surface of the parent body.

Eg. Hydra, when food is plenty, the ectoderm cells increase and form a small elevation on the body surface Ectoderm and endoderm are pushed out to form the Bud.

- The bud enlarges, develops a mouth and a circle of tentacles at its free end.
- When fully grown, the bud constricts at the base and finally separates from the parent body and leads an independent life.



**Budding in Hydra**

**Endogenous Budding** : Hundreds of buds are formed inside the cytoplasm and many remain within the body of the parent. Eg. Noctiluca.





**Positive eugenics**

i) Positive eugenics attempts to increase consistently better or desirable germplasm and to preserve the best germplasm of the society. The desirable traits can be increased by adopting the following measures.

- i) Early marriage of those having desirable traits.
- ii) Subsiding the fit and establishing sperm and egg banks of precious germplasm
- iii) Educating the basic principles of genetics and eugenics.

iv) Improvement of environmental conditions.

v) Promotion of genetic research

**ii) Negative eugenics**

Negative Eugenics attempts to eliminate the defective germplasm of the society by adopting the following measures.

- i) Sexual separation of the defectives.
- ii) Sterilization of the defectives.
- iii) Control of immigration and
- iv) Regulation of marriages

**PART II - ADDITIONAL QUESTIONS****I. Choose the correct answer**

1. Who is the founder of Modern Eugenics movement?

- a) Mendel
- b) Darwin
- c) Francis Galton
- d) Karl Pearson

Ans : c) Francis Galton

2. Improvement of human race by encouraging the healthy persons to marry early and produce large number of children is called

- a) Positive eugenics
- b) Negative eugenics
- c) Positive eugenics
- d) positive euphenics

Ans : a) Positive eugenics

3. The \_\_\_\_\_ deals with the control of several inherited human diseases especially inborn errors of metabolism

- a) Euphenics
- b) Eugenics
- c) Euthenics
- d) All of these

Ans : a) Euphenics

**II. Two Mark Questions**

1. What is Eugenics?

Application of the laws genetics for this improvement of race is called eugenics. The term eugenics means "Well born"

**Methods :**

- (i) Constructive method (or) positive eugenics
- (ii) Restrictive method (or) Negative eugenics

2. Define positive eugenics.

Positive eugenics attempts to increase consistently better or desirable germ plasm and to preserve the best germplasm of the society.

3. What are the steps to increase positive Eugenic development?

- Early marriage of those having desirable traits
- Subsiding the fit and establishing sperm and egg banks of precious germ plasm.
  - Educating the basic principles of genetics and Eugenics
  - Improvement of environmental conditions.
  - Promotion of genetic research.

4. What is Negative Eugenics?

Negative Eugenics attempts to eliminate the defective germplasm of the society by adopting.

5. What are the actions to be taken in Negative Eugenics development?

- Sexual separation of the defectives
- Sterilization of the defectives.
- Control of immigration
- Regulation of marriages.

6. What is Euphenics or medical engineering?

- The symptomatic treatment of genetic disease of man is called Euphenics or medical engineering
- It means normal appearing.

7. Define Euthenics.

The science of improvement of existing human race by improving the environmental conditions is called Euthenics.

**8. What are the components of Environmental development?**

- Better nutrition.
- Better unpolluted ecological conditions.
- Better Education
- Sufficient medical facilities.

**9. What cellular organisms are involved in Chromosomal gene inheritance?**

- Chloroplast
- Mitochondria
- Plasmids

**10. Why unconventional inheritance depends on the cosmic cell impact?**

- There is less cytoplasm in the sperm cell of male.
- Those cells of women have high level of cytoplasm.
- Thus, mutagenic inheritance depends on the cosmic cell impact.

**11. What is meant by extra chromosomal inheritance?**

Certain characters are controlled by non-nuclear genomes found in chloroplast, mitochondria infective agents and plasmids.

**12. What is the cause for difference in non mendelian results with chromosomal inheritance?**

- Male and female parents contribute equally their nuclear genes to the progeny.
- But donot make equal contribution of extra chromosomal genes.
- Hence the crosses can yield different (or) non mendelian results.

**13. Gynandromorph - Define?**

- These individuals have parts of their body.
- Expressing male characters and other parts of the body expressing female characters.

**14. What is mean by Euphenics?**

The Symptomatic treatment of genetic disease of man is called Euphenics or Medical engineering.

## PART I - TEXTBOOK EVALUATION

1. The first life on earth originated  
a) in air      b) on land  
c) in water    d) on mountain  
**Ans : c) in water**
- 
2. Who published the book " Origin of species by Natural Selection " in 1859?  
**S.V. Aug-2022**  
a) Charles Darwin    b) Lamarck  
c) Weismann          d) Hugo de Vries  
**Ans : a) Charles Darwin**
- 
3. Which of the following was the contribution of Hugo de Vries?  
**S.V. Aug-2021**  
a) Theory of mutation  
b) Theory of natural Selection  
c) Theory of inheritance of acquired characters  
d) Germplasm theory  
**Ans:a) Theory of mutation**
- 
4. The wings of birds and butterflies is an example of  
a) Adaptive radiation  
b) convergent evolution  
c) divergent evolution    d) variation  
**Ans :b) convergent evolution**
- 
5. The phenomenon of "Industrial Melanism" demonstrates  
**L.V. Aug-2022**  
a) Natural selection    b) induced mutation  
c) reproductive isolation  
d) geographical isolation  
**Ans : a) Natural selection**
- 
6. Darwin's finches are an excellent example of  
a) connecting links    b) seasonal migration  
c) adaptive radiation    d) parasitism  
**Ans : c) adaptive radiation**
- 
7. Who proposed the Germplasm theory?  
**L.V. Aug-2021**  
a) Darwin              b) August Weismann  
c) Lamarck            d) Alfred Wallace  
**Ans : b) August Weismann**
- 
8. The age of fossils can be determined by  
a) electron microscope  
b) weighing the fossils  
c) carbon dating  
d) analysis of bones    **Ans : c) carbon dating**
- 
9. Fossils are generally found in  
a) igneous rocks      b) metamorphic rocks  
c) volcanic rocks      d) sedimentary rocks  
**Ans : d) sedimentary rocks**
- 
10. Evolutionary history of an organism is called  
a) ancestry              b) ontogeny  
c) phylogeny            d) paleontology  
**Ans : c) phylogeny**
- 
11. The golden age of reptiles was  
**L.V. Aug-2021**  
a) Mesozoic era        b) Cenozoic era  
c) Paleozoic era        d) Proterozoic era  
**Ans : a) Mesozoic era**
- 
12. Which period was called " Age of fishes " ?  
**S.V. MAY-2022    L.V. Aug-2022**  
a) Permian              b) Triassic  
c) Devonian            d) Ordovician  
**Ans : c) Devonian**
- 
13. Modern man belongs to which period?  
a) Quaternary          b) Cretaceous  
c) Silurian              d) Cambrian  
**Ans : a) Quaternary**
- 
14. The Neanderthal man had the brain capacity of  
a) 650-800cc      b) 1200cc  
c) 900cc              d) 1400cc    **Ans : d) 1400cc**
- 
15. According to Darwin, the organic evolution is due to.  
a) Intraspecific competition  
b) Interspecific competition  
c) Competition within closely related species.  
d) Reduced feeding efficiency in one species due to the presence of interfering species.  
**Ans: b) Interspecific competition**

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16. A population will not exist in Hardy - Weiberg equilibrium if. **L.V. MAR-2020**

- Individuals mate selectively **L.V. MAY-2022**
- There are no mutations
- There is no migration
- The population is large.

**Ans: a) Individuals mate selectively**

17. List out the major gases seems to be found in the primitive earth. **L.V. MAY-2022**

- The primitive earth had no proper atmosphere
- It consisted of ammonia, methane, hydrogen and water vapour.
- UV rays split water molecules into hydrogen and oxygen.
- Ammonia and methane combined with oxygen to form carbon dioxide and other gases.

18. Explain the three major categories in which fossilization occur?

1) **Actual Remains.**

- Original hard parts like bone, teeth and shells are preserved.
- Hard parts of marine animals like bones, shells are sedimented.
- They are protected from deterioration.
- Salinity of ocean prevents decay.
- Woolly mammoths (22000 yrs ago) preserved in the frozen Siberian coast.

- Human beings and animals of ancient city of Pompeii preserved in volcanic ash from Mount Vesuvius.

2) **Petrifaction**

- Original body portions of dead animals were replaced molecule for molecule by minerals.

- Original substance got disintegrated.

- Principal minerals involved are iron pyrites, silica, calcium carbonate and bicarbonates of calcium, magnesium.

**Natural moulds and casts:**

**Mould**

- Impressions of animals on soft mud harden into stones. These are moulds.

**Casts**

- The cavities of moulds are filled up with hard minerals. They get fossilized. They are called casts.

**Coprolites**

- Faecal matter were hardened into tiny pellets called coprolites. From this we understand the nature of diet of prehistoric animals.

19. Differentiate between divergent evolution and convergent evolution with one example for each. **GMQ - 2019 L.V. MAR-2020**

Divergent Evolution	Convergent Evolution
➤ Homologous structures bring about divergent evolution.	Analogous structures bring about convergent evolution.
➤ Homologous structures are similar in origin. They perform different functions.	Analogous structures have different structural patterns but similar function.
<b>Examples in animals</b> Vertebrate forelimbs have anatomical similarity (similar bones like humerus, radius, ulna, carpals, metacarpals, phalanges.)	<b>Example in animals</b> ➤ Eyes of octopus, mammals ➤ Flipper of penguin, dolphin
<b>Example in plants</b> ➤ Thorn of Bougainvillea and tendrils of cucurbita, Pisum sativum. ➤ Thorn - defence ➤ Tendril - climbing.	<b>Example in plants</b> ➤ Root modification in sweet potatoes ➤ Stem modification in potato ➤ Both are having common function - storage of food.

20. How does Hardy -Weinberg's expression ( $P^2+2pq+q^2=1$ ) explain that genetic equilibrium is maintained in a population? List any four factors that can disturb the genetic equilibrium. **L.V. MAY-2022**

**Population of beetles :**

- i) Appear in 2 colours and the colour is determined.
- ii) Dark grey (black) = 'AA' and 'Aa'
- iii) Light grey - 'aa'
- iv) 'A' allele has a frequency (p) 0.3 and 'a' allele has a frequency (q) 0.7
- v) The genotype frequency can be estimated by Hardy Weinberg equation.
 
$$(P+q)^2 = p^2 + 2pq + q^2$$

$$p^2 = \text{frequency of AA}$$

$$2pq = \text{frequency of Aa}$$

$$q^2 = \text{frequency of aa}$$

$$P^2 = 0.3, q = 0.7 \text{ then,}$$

$$p^2 = (0.3)^2 = 0.09 = 9\% \text{ AA}$$

$$2pq = 2(0.3)(0.7) = 0.42 = 42\% \text{ Aa}$$

$$q^2 = (0.7)^2 = 0.49 = 49\% \text{ aa}$$
 Hence the beetle population appears to be in Hardy - Weinberg equilibrium.  
 Four factors disturbing genetic equilibrium
  - Gene flow      ➤ Genetic drift
  - Mutation      ➤ Natural selection

21. Explain how mutations, natural selection and genetic drift affect Hardy Weinberg equilibrium. **PTA-1**

- Hardy and Weinberg stated that the allele frequencies in a population are stable and are constant from generation to generation in the absen of gene flow, genetic drift, mutation, recombination and natural selection.
  - Hence population in Hardy Weinberg is not evolving.
- Hardy Weinberg's assumptions include**
- i) **No mutation :** No new alleles are generated by mutation nor the genes get duplicated or deleted.

- ii) **Random mating:** Every organism gets a chance to mate and the mating is random with each other with no preferences for a particular genotype.
- iii) **No gene flow:** Neither individuals nor their gametes enter (immigration) or exit (emigration) the population.
- iv) **Very large population size:** The population should be infinite in size.
- v) **No natural selection :** All alleles are fit to survive and reproduce.

22. How did Darwin explain fitness of organisms?

Charles Darwin noted a huge variety and remarkable similarities among organisms and their adaptive features to cope up to their environment. He proved that fitness organisms can survive and leave more progenies than the unfit ones through natural selection.

Darwin's theory was based on several facts, observations and influences. They are.

1. **Over production (or) prodigality of production.**  
All living organisms increase their population in larger number.
2. **Struggle for existence**  
➤ Darwin denoted struggle for existence in three ways.  
➤ Darwin believed that the struggle for existence resulted in the survival of the fittest.  
➤ Such organisms become better adapted to the changed environment.
3. **Universal occurrence of variations**  
➤ No two individuals are alike. There are variations even in identical twins.  
➤ The useful variations found in an organism help them to overcome struggle and such variations are passed on to the next generation.
4. **Origin of species by Natural Selection**  
➤ According to Darwin, nature is the most powerful selective force.

**23. Mention the main objections to Darwinism.****Qty - 2019 GMQ - 2019 L.V. AUG - 2021**

- Failed to explain the mechanism of variation.
- Explains the survival of the fittest not the arrival of the fittest.
- Darwin focused on small fluctuating non-heritable variations.
- Did not distinguish somatic and germinal variation.
- He could not explain the vestigial organs, over specialisation.  
Ex) Large tusk in extinct Mammoth (over specialization) oversized antler in Irish deer.

**24. Taking the example of Peppered moth, explain the action of natural selection. What do you call the above phenomenon? Industrial Melanism. PTA-4**

- **Example : Natural selection** exhibited by the peppered moth (*Biston betularia*)
- In England before industrialization, the peppered moth were in 2 colours, white and black.
- Pre-industrialization witnessed white coloured background in the building walls.
- So, the white coloured moths escaped from predators in white background.
- During post-industrialization, the tree trunks became dark by smoke, soot.
- Black moths camouflaged in dark background.
- White moths were easily identified by the predators.
- Dark coloured moth population was selected. Their number increased.
- Nature offered positive selection pressure to the black moths.
- Adaptable organisms increase in population through natural selection.

**25. Darwin's finches and Australian marsupials are suitable examples of adaptive radiation - Justify the statement. Adaptive Radiation: L.V. MAR-2020**

- It is an evolutionary process.

- A new species diverge from a single ancestral form. It becomes adapted to newly invaded habitat.

**Darwin's finches**

- 2 million years ago, their common ancestor arrived on the Galapagos islands.
- Darwin's finches evolved into 14 recognized species.
- They differ in body size, beak shape and feeding behaviour.
- Change in size and form of beak helped to use different food like insects, seeds, nectar from cactus flowers and blood of iguanas.

**Marsupials in Australia**

- 100 million years ago, they came from the common ancestor and evolved independently.
- Marsupials have undergone adaptive radiation. They occupy diverse habitats in Australia.

**26. Who disproved Lamarck's Theory of acquired characters? How? L.V. SEP-2020 S.V. SEP-2020 S.V. MAY-2022**

- Lamarck's Theory of Acquired characters, was disproved by August Weismann.
- He conducted experiments on mice. He cut their tails for 20 generations and breeding them.
- All mice were born with tails.
- Change in somatoplasm will not be transferred to the next generation.
- Changes in the germplasm will be inherited.

**27. How does Mutation theory of De Vries differ from Lamarck and Darwin's view in the origin of new species. Mutations theory of Devries**

- Mutations are sudden random change that occur in an organism. It is not inheritable  
Example He observed that variations in the Evening Primrose (*Oenothera Lamarckiana*) are due to mutation.
- Sudden, large variations were responsible for the origin of new species.
- Lamarck and Darwin believed in gradual accumulation of variations. These are the causative factors in the origin of new species.

**28. Explain stabilizing, directional and disruptive selection with examples.****Stabilising Selection.**

- Operates in a stable environment.
- Organisms with average phenotypes survive.
- Extreme individuals from both the ends are eliminated.
- No speciation.
- Phenotypic stability maintained within the population over generation.
- **Example** Measurement of sparrows that survived the storm clustered around the mean.
- Sparrows that failed to survive the storm clustered around the extremes of variation. This shows stabilising selection.

**Directional Selection**

- Gradually changing environment is subjected to the directional selection.
- Individuals from one end are removed towards the other end of phenotypic distribution.
- **Example** Size difference between the male, female sparrows.
- Male and female are externally alike. They differ in body weight.
- Females show directional selection in relation to body weight.

**Disruptive Selection**

- Homogeneous environment changes into heterogeneous environment. Now this type of selection operates.

- Organisms of both extreme phenotypes are selected.
- Individuals with average phenotypes are eliminated.
- The population is splitted into subpopulation or species.
- It leads to the formation of two or more different species. It is also called adaptive radiation.
- Example : The beak size of Darwin's finches in relation to seed size in Galapagos islands.

**29. Rearrange the descent in human evolution.**

- Australopithecus → Homo erectus → Homo sapiens → Ramapithecus → Homo habilis.
- Ramapithecus → Australopithecus → Homo habilis → Homo erectus → Homo sapiens.

**30. How does Neanderthal man differ from the modern man in appearance?**

- Neanderthal man is different from modern man in having
- Semierect posture
  - Flat cranium
  - Sloping forehead
  - Thin large orbits.
  - Heavy brow ridges
  - Protruding jaws without chin.

**PART II - GMQ, PTA AND GOVT. QUESTIONS ANSWERS****I. Match the following****1. Match the following and find the correct answer. PTA-5**

- i) Tertiary period - (A) Age of fishes
- ii) Jurassic period - (B) Dominance of invertebrates
- iii) Devonian period - (C) Mammals and birds
- iv) Ordovician - (D) Golden age of Reptiles
- a) (i) B (ii) C (iii) D (iv) A
- b) (i) C (ii) D (iii) B (iv) A

c) (i) D (ii) C (iii) B (iv) A

d) (i) C (ii) D (iii) A (iv) B

**Ans : d) (i) C (ii) D (iii) A (iv) B****II. Choose the correct answer.****1. Which is the correct order of human evolution? PTA-6**

- a) Hominid → Homo habilis → Homo erectus → Homo sapiens
- b) Homo habilis → Homo erectus → Hominids → Homo sapiens

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- c) Homo erectus → Homo habilis → Hominids → Homo sapiens.  
 d) Homo habilis → Hominids → Homo erectus → Homo sapiens

**Ans : a) Hominid → Homo habilis → Homo erectus → Homo sapiens**

**2. Sudden appearance of vestigial organs in highly evolved organisms is called** **QTY - 2019**

- a) vestigial organs b) connecting links  
 c) Atavistic organs d) Adaptive radiation

**Ans : c) Atavistic organs**

**3. Age of fishes** **L.V. Aug - 2022**

- a) Devonian b) Mississippian  
 c) Cambrian d) Ordovician

**Ans : a) Devonian**

**III. Very Short Answer (2 Marks)**

**1. State the theory of chemical evolution.** **PTA-2**

According to the theory of chemical evolution primitive organisms in the primordial environment of the Earth evolved spontaneously from inorganic substances and physical forces such, as lightning. UV radiations, volcanic activities, etc.

**2. What is the role of connecting links in evolution?** **PTA-3**

The organisms which possess the characters of 2 different groups are called connecting links. They provide the evidence for the path of evolution and lie mid way between the two groups.

**Examples :**

- 1) Peripatus connects Annelida and Arthropoda  
 2) Archaeopteryx connects Reptiles and Aves

**3. What is the evolutionary significance of Archaeopteryx?** **PTA-2**

- Archaeopteryx plays an important role in the evolution because it is a connecting link between Aves and reptiles. Archaeopteryx have wings like birds and tail and teeth like reptiles therefore it is suggested that birds are evolved from reptiles.

**4. What are called connecting links? Give examples.** **HY - 2019 PTA-3**

The organisms which possess the characters of two different groups (transitional stage) are called connecting links.

Eg. Peripatus (connecting link between Annelida and Arthropoda), Archeopteryx (Connecting link between Reptiles and Aves)

**5. What do you know about coacervates?** **S.V. Aug - 2021**

Large colloidal particles that precipitate out in aqueous medium. The first pre-cells which gradually transformed into living cells.

**6. Who coined the term Abiogenesis? What does it describe? (or) State the theory of spontaneous generation?** **S.V. AUG-2022**

- Thomas Huxley coined the term Abiogenesis.  
 ➤ Abiogenesis tells that living organisms originated from non-living materials.  
 ➤ It occurred through stepwise chemical and molecular evolution over millions of years.

**IV. Short Answer (3 Marks)**

**1. Differentiate Relative dating from Absolute dating.** **PTA-3 S.V. AUG-2022**

Relative dating	Absolute dating
Relative dating is used to determine a fossil by comparing it to similar rocks and fossils of known age.	Absolute dating is used to determine the precise age of a fossil by using radiometric dating to measure the decay of isotopes.

**2. Gene flow can be strong agent of evolution. Explain how?** **PTA-5**

- Movement of genes through gametes or movement of individual in (immigration) and out (emigration) of a population is referred as gene flow.  
 Organism and gametes that enter the population may have new alleles or may bring in existing alleles but in different proportions than those already in the population.  
 ➤ Hence Gene flow is a strong agent of evolution.



3. Give the salient features of Mutation Theory. **OY - 2019 S.V. Aug - 2021**

- Mutations or discontinuous variation are transmitted to other generations.
- In naturally breeding populations, mutations occur from time to time.
- There are no intermediate forms, as they are fully fledged.
- They are strictly subjected to natural selection.

4. What is Petrification? **HY 2019**

**Petrification :**

- When animals die, the original portion of their body may be replaced molecule for molecule by minerals and the original substance being lost through disintegration.
- This method of fossilization is called petrification.
- The principle minerals involved in this type fossilization are iron pyrites, silica, calcium carbonate and bicarbonates of calcium and magnesium.

5. In a population let's say that 'A' allele has frequency (p) of 0.2 and 'a' allele has frequency (q) of 0.8. Then  $p+q=1$ . Find out the next generation percentage for AA, Aa and aa genotypes. **L.V. Sep - 2020**

Ans :  $p + q = 1$

**Hardy Weinberg equation :**

$$(p + q)^2 = p^2 + 2pq + q^2$$

**Given :**

$$p = 0.2, q = 0.8$$

**Next generation percentage :**

Genotype	Frequency	Percentage
1. AA	$p^2$ $0.2 \times 0.2 = 0.04$	4%
2. Aa	$2pq$ $2 \times (0.2) \times (0.8) = 0.32$	32%
3. aa	$q^2$ $0.8 \times 0.8 = 0.64$	64%

**V. Five Mark Questions**

1. What are the assumptions included in Hardy Weinberg principle? Explain them.

➤ **No mutation** - No new alleles are generated by mutation nor the genes get duplicated or deleted. **PTA-1**

➤ **Random mating** - Every organism gets a chance to mate and the mating is random with each other with no preferences for a particular genotype.

➤ **No gene flow** - Neither individuals nor their gametes enter (immigration) or exit (emigration) the population.

3. It produces variation in offsprings.

ii) **Chromosomal mutations.**

1. change in the structure of chromosome.

2. It is due to deletion, addition, duplication, inversion and translocation.

3. It alters the phenotype.

4. It produces variation in offspring.

iii) **Genetic recombination.**

1. It is due to crossing over of genes in meiosis.

2. Genetic variations leads to heritable variations.

iv) **Natural selection.**

➤ Natural selection does not produce genetic variations.

➤ Natural selection favours some genetic changes. Others are rejected.

v) **Reproductive isolation.**

Interbreeding is prevented between related organisms.

2. Comment on chemical evolution. **PTA-2**

1. **Introduction.**

Primitive organisms evolved from inorganic substances by physical forces like lightning, uvradiation and volcanic activities.

2. **Oparin's view. (1924)**

i) By series of reactions, organic compounds formed complex molecules.

ii) Colloidal aggregates called coacervates are formed in aqueous environment.

iii) Coacervates absorbed and assimilated organic compounds from environment.

3. **Haldane's view. (1929)**

i) Primordial sea was a chemical laboratory with solar energy.

- ii) Atmosphere was O<sub>2</sub> free.
- iii) CO<sub>2</sub>, NH<sub>3</sub>, and uv radiations combined to form organic compounds.
- iv) The sea was a hot dilute soup of organic monomers and polymers.
- v) These organic monomers, polymers acquired lipid membranes. Thus they developed into the first living cell.
- vi) Haldane coined the term 'probiotic soup'.

#### 4. Conclusion.

Oparin and Haldane suggested this, The primitive reducing atmosphere with energy from lightning, UV light synthesized organic compounds.

#### 3. How was natural selection explained in the light of post - Darwinian discoveries? Discuss? Explain the modern synthetic theory of natural selection. **PTA-5**

- 1) Natural selection was explained in the light of post-Darwinian discoveries by Sewall wright, Fisher, Mayer, Huxley, Dobzhansky, Simpson and Haeckel.
- 2) There are 5 factors in the process of organic evolution.

#### I. Gene mutation. (Point mutation)

1. It is the change in the structure of gene.
2. It alters the phenotype.
3. It produces variation in offsprings.

#### ii) Chromosomal mutations.

1. Change in the structure of chromosome.
2. It is due to deletion, addition, duplication, inversion and translocation.
3. It alters the phenotype.
4. It produces variation in offspring.

#### iii) Genetic recombination.

- 1 It is due to crossing over of genes in meiosis.
2. Genetic variations leads to heritable variations.

#### iv) Natural selection.

- Natural selection does not produce genetic variations.
- Natural selection favours some genetic changes. Others are rejected.

#### v) Reproductive isolation.

Interbreeding is prevented between related organisms.

#### 4. Explain the evolutionary path of man.

**S.V. MAR-2020**

Mammals evolved in the early Jurassic period, about 210 million years ago.

**Hominid:** Hominid evolutions occurred in Asia and Africa. Hominids proved that human beings are superior to other animals and efficient in making tools and culture.

- The earliest fossils of the prehistoric man like Ramapithecus and Sivapithecus lived some 14 mya and were derived from ape like Dryopithecus.
- Dryopithecus and Ramapithecus were hairy and walked like gorillas and chimpanzees.

**Australopithecus:** Lived in East Africa grasslands about 5 mya and was called the Australian ape man. He was about 1.5 meters tall with bipedal locomotion omnivorous, semi erect and lived in caves. Low forehead, brow ridges over the eyes, protruding face, brain is 350-450 cc

**Homo habilis:** lived about 2 mya. Their brain capacity was between 650-800 cc and was probably vegetarian. They had bipedal locomotion and used tools made of chipped stones.

**Homo erectus :** The first human like being was around 1.7 mya and was much closer to human in looks, skull was flatter and thicker than the modern man, brain capacity is 900 cc. Homo erectus probably ate meat.

**Homo ergaster** and Homo erectus were the first to leave Africa.

**Neanderthal :** Human was found in Neander valley, Germany with a brain size of 1400 cc and lived between 34,000 - 1,00,000 years ago. They differ from the modern human in having semierect posture, heavy brow ridges, protruding jaws and no chin. They used animal hide to protect their bodies knew the use of fire and buried their dead.

**Cro-magnon** was one of the most talked forms of modern human found from the rocks of cro-magnon, France and is considered as the ancestor of modern Europeans. They are also known for

their cave painting's figures on floors and walls. They were adapted to various environmental conditions.

**Homo sapiens** or modern human arose in Africa some 25,000 years ago and moved to other continents and developed into distinct races. They are cultivating crops and domesticating animals.

### 5. What are vestigial organs?

Give an example.

**S.V. SEP-2020**

**Vestigial organs:**

Remnants of functional structures of ancestors. They disappeared in evolution due to non-utilization.

**Example :**

#### 1. Human vermiform appendix.

- It is a remnant of caecum.
- It helped in cellulose digestion in herbivores (rabbit).
- Due to change in diet with less cellulose, caecum became functionless. It is reduced into a vestigial organ.

**Other Examples**

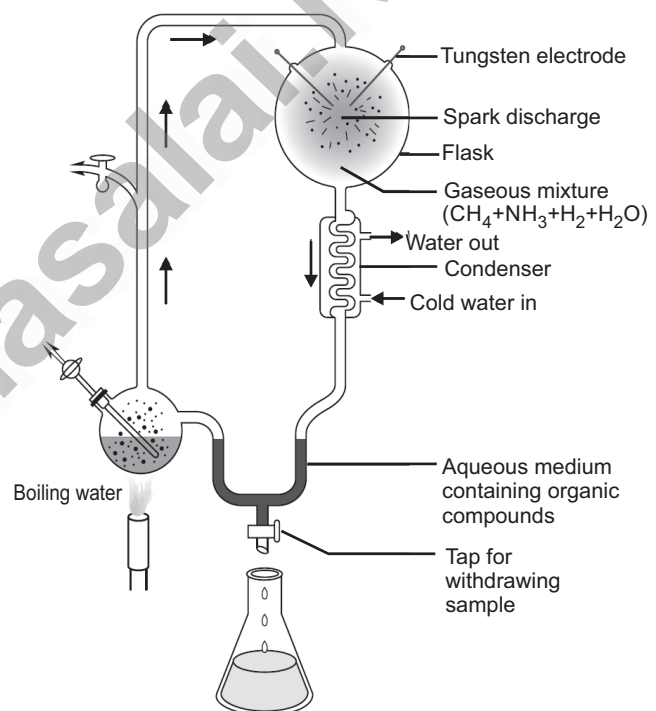
1. Coccyx
2. Wisdom teeth
3. Ear muscle
4. Body hair
5. Mammae of males
6. Nictitating membrane of eye

### 6. Prove that the synthesis of organic compounds led to the appearance of living organisms? (or) Describe the origin of life with the experiment by urey and miller.

**L.V. AUG-2022**

Urey - Miller Experiment

- Steam from the boiling flask was mixed with gases like ammonia, methane, hydrogen.
- These gases are circulated over electric discharge from tungsten electrode
- These are condensed and run down into a 'U' tube.
- After a week of running the experiment, the liquid was analysed.
- It has glycine, alanine, beta alanine and aspartic acid.
- This is the a biogenetic synthesis of organic compounds from gases mixture.
- Methane was the only source of carbon.
- Later all types of aminoacids, nitrogen bases were noticed.



## PART III - ADDITIONAL QUESTIONS

### I. Match the following

1.	Column A		Column B
A	Abiogenesis	1	Haldane
B	Biogenesis	2	Oparin
C	Coacervates	3	Henry Bastian
D	Prebiotic Soup	4	Thomas Huxley

- a) A-4, B-3, C-2, D-1
- b) A-1, B-2, C-3, D-4
- c) A-3, B-2, C-4, D-1
- d) A-3, B-4, C-1, D-2

**Ans : a)A-4, B-3, C-2, D-1**

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EC 12th Bio-Zoology

2.	Column A		Column B
A	Ramapithecus	1	Modern human
B	Australopithecus	2	Bipedal locomotion
C	Homo habilis	3	Australian Apeman
D	Homo sapiens	4	Walked like gorilla

- a) A-4, B-3, C-2, D-1      b) A-1, B-2, C-3, D-4  
c) A-4, B-3, C-1, D-2      d) A-2, B-1, C-4, D-3

Ans : a) A - 4, B - 3, C - 2, D - 1

3.	Column A		Column B
A	Homo Sapiens	1	650-800 CC
B	Neanderthal man	2	900 CC
C	Homo habilis	3	1300-1600 CC
D	Homo eructus	4	1400 CC

- a) A-4, B-3, C-2, D-1      b) A-3, B-4, C-1, D-2  
c) A-1, B-2, C-3, D-4      d) A-2, B-1, C-4, D-3

Ans : a) A-3, B-4, C-1, D-2

### II. Choose the correct answer.

- The term Biogenesis was coined by  
a) Thomas Huxley    b) Henry Bastian  
c) Oparin            d) Haldane  
Ans : Henry Bastian
- Molecules used to study evolution.  
a) DNA                b) rRNA  
c) Cytochrome - C    d) all      Ans : d) all
- Natural selection was not explained in the light of post - Darwinian discoveries by  
a) Fisher            b) Mayer  
c) Huxley            d) Wallace      Ans : d) Wallace
- Size difference between male and female sparrows is the example for \_\_\_\_ selection.  
a) Stabilising    b) Directional  
c) Disruptive    d) Group      Ans: b) Directional
- Darwin's finches beak size in relation to seed size in Galapagos islands is an example of \_\_\_\_ selections.  
a) Stabilising    b) Directional  
c) Disruptive    d) Group  
Ans : c) Disruptive

- Measurement of sparrows that survived the storm is due to \_\_\_\_ selection.  
a) Stabilising    b) Directional  
c) Disruptive    d) Group      Ans : a) Stabilising
- \_\_\_\_\_ can be a strong agent of evolution  
a) Gene flow    b) Genetic drift  
c) Mutation     d) Sewall wright effect  
Ans : a) Gene flow
- The first human being is \_\_\_\_\_  
a) Homo erectus      b) Homo ergaster  
c) Homo sapiens      d) Homo habilis  
Ans : a) Homo erectus
- \_\_\_\_\_ derived from Dryopithecus  
a) Ramapithecus    b) Sivapithecus  
c) Both                d) None      Ans : c) Both
- First to leave Africa is Homo \_\_\_\_\_  
a) erectus            b) Sepiens  
c) habilis            d) Hominids      Ans : a) erectus
- \_\_\_\_\_ lived in East African grass lands.  
a) Ramapithecus      b) Sivapithecus  
c) Australopithecus    d) Dryopithecus  
Ans : c) Australopithecus
- Age of Invertebrates  
a) Combrian            b) Ordovician  
c) Devonian            d) Mississippian  
Ans : a) Combrian
- Emergence of modern birds \_\_\_\_ period  
a) Triassic            b) Jurassic  
c) Cretaceous        d) Permian  
Ans: c) Cretaceous
- Origin of man from man like apes is during  
a) Pliocene            b) Miocene  
c) Oligocene        d) Paleocene  
Ans : a) Pliocene
- \_\_\_\_\_ era is of 3000 million years  
a) Palacozoic        b) Mesozoic  
c) Cenozoic        d) Precambrian  
Ans : d) Precambrian
- Origin of Algae is during \_\_\_\_ period  
a) Cambrian            b) Ordovician  
c) Devonian            d) Permian  
Ans : a) Cambrian
- \_\_\_\_\_ Epoch is the age of mammals.  
a) Miocene            b) Pliocene  
c) Pleistocene        d) Holocene  
Ans : d) Holocene

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18. Appear of first land plants was during \_\_\_\_\_ period.

- a) Ordovician b) cambrian  
c) Siluvian d) Devonian

Ans : Ordovician

19. \_\_\_\_\_ helps us to understand the diet of prehistoric animals

- a) Mould b) Casts  
c) Coprolites d) Petrified fossils

Ans : c) Coprolites

20. Principle mineral not involved petrification.

- a) Iron pyrite b) Silica  
c) Calcium d) Sulphur

Ans : d) sulphur

21. Not formed in urey miller Experiment.

- a) Arginine b) glycine  
c) Alanine d) Aspartic acid

Ans: a) Arginine

22. Age of Angiosperms is \_\_\_\_\_ period

- a) Tertiary b) Quaternary  
c) Cretaceous d) Jurassic

Ans: a) Tertiary

23. Method of food procurement in Monera, Protista

- a) Predator b) Animalism  
c) photosynthesis d) All

Ans: d) All

24. The famous museum in Chennai is \_\_\_\_\_ museum

- a) Egmore b) Central  
c) T.Nagar d) Velachery

Ans : a) Egmore

25. Philosophic zoologique book was written by

- a) Darwin b) Mendel  
c) Lamarck d) De Uries

Ans : c) Lamarck

26. Theory of Acquired characters was disproved by

- a) Cope b) Osbour  
c) Spencer d) August weismann

Ans : d) August weismann

27. The slowest breeder is

- a) Salmon b) Elephant  
c) Man d) Gorilla

Ans : b) Elephant

28. Mutation theory was proposed by

- a) Lamarck b) Darwin  
c) Devries d) Simpson

Ans : c) Devries

29. Darwin's finches arrived Galapagos islands \_\_\_\_\_ million years ago.

- a) 2 b) 20 c) 22 d) 12

Ans : a) 2

30. Darwin finches are of \_\_\_\_\_ species

- a) 4 b) 14 c) 40 d) 41

Ans : b) 14

31. No of species of Marsupials in Australia \_\_\_\_\_ species.

- a) 100 b) 200 c) 20 d) 400

Ans : b) 200

32. Group selection is

- a) Altruism b) Kin selection  
c) Both d) None

Ans : c) Both

33. Founder's effect is due to

- a) Gene flow b) Mutation  
c) Genetic drift d) Natural selection

Ans : c) Genetic drift

34. Hardy Weinberg's assumptions include

- a) No mutation b) No gene flow  
c) No natural selection d) All the above

Ans : d) All the above

### III. Find the correct statement

1. a) The leg of cat and flipper of whale are homologous structures.  
b) Wings of birds and insects are examples of adaptive radiation.  
c) Tail in a human baby is a vestigial organ.  
d) Nictitating membrane is atavistic organ.  
Ans : a) The leg of cat and flipper of whale are homologous structures.

2. a) Lamarks's "Theory of Acquired characters" was proved by August Weismann.  
b) conducted experiments on mice for thirty generations by cutting their tails and breeding them.  
c) All mice born were with tail  
d) Weismann proved his germplasm theory that change in the somatoplasm will be transferred to the next generation but changes in the germplasm will be inherited.

Ans : c) All mice born were with fail

#### IV. Find the wrong statement

- Nucleoproteins in cell substance is called monera.
  - Nucleoproteins separated from cell substance by thin membrane in protista.
  - O<sub>2</sub> combined with CH<sub>4</sub> to form CO<sub>2</sub>
  - CO<sub>2</sub> Combined with NH<sub>3</sub> to form Nitrogen.

**Ans : d) CO<sub>2</sub> Combined with NH<sub>3</sub> to form Nitrogen.**

- Darwin explained the mechanism of variation
  - Darwinism does not explain the arrival of the fittest
  - Darwin did not distinguish somatic and germinal variation
  - Darwin could not explain over specialization

**Ans : a) Darwin explained the mechanism of variation**

#### V. Assertion and Reason

- A and R are true and R is the correct explanation of A
- A and R wrong but R is not the correct Explanation of A
- A and R are false
- A is correct R is false

- Assertion :** The Paleozoic era is characterised by abundance of fossils of marine invertebrates.

**Reason :** Towards the later Half, Other vertebrates except birds and mammals appeared

**Ans : a) A and R are true and R is the correct explanation of A**

- Assertion :** According to Darwin nature is the most powerful selective force.

**Reason :** He compared origin of species by natural selection to a small isolated group.

**Ans : a) A and R are true and R is the correct explanation of A**

- Assertion :** When the natural sources of food in the ocean declined in course of time the ancestors of Monera and Protista had to evolve different methods for food procurement.

**Reason :** These may be summarized as parasitism saprophytism, predator or animalism and chemozyntesis or photosynthesis.

**Ans : a) A and R are true and R is the correct explanation of A**

- Assertion :** The original hard parts such as bones, teeth or shells are preserved as such in the earth's atmosphere.

**Reason :** This is the rare common method of fossilization.

**Ans : d) A is correct R is false**

#### VI. Choose the correct pair

- Fish - 3 chambered Heart
  - Amphibians - 2 chambered Heart
  - Crocodiles - 3 chambered Heart
  - Birds - 4 Chambered Heart

**Ans : d) Birds - 4 Chambered Heart**

- Permian period - Earliest Amphibians
  - Carboniferous - Mammal like reptiles
  - Devonian period - Land Invertebrates
  - Silurian period - Earliest fishes

**Ans : d) Silurian period - Earliest fishes**

#### VII. Choose the Incorrect pair

- Quaternary period - Monocotyledons
  - Tertiary period - Dicotyledons
  - Cretaceous period - Conifers
  - Jurassic period - Cycads

**Ans : c) Cretaceous period - Conifers**

- Mississippian - Age of fossils
  - Jurassic - Golden age of Reptiles
  - Pliocene - Age of Human being
  - Holocene - Age of Mammals

**Ans : a) Mississippian - Age of fossils**

#### VIII. Odd man out

- Not a vestigeal organ**

- Coccyx
- Wisdom teeth
- Mammae in male
- Tail in man's embryo

**Ans : d) Tail in man's embryo**

2. **Not a Neo - Lamarckian**  
a) Heinrich b) Cope  
c) Osborn d) Packard **Ans: a) Heinrich**
- 
3. a) Triassic b) Jurassic  
c) Cretaceous d) Tertiary **Ans: a) Tertiary**
- 
4. a) Haeckel b) Lamarck  
c) Mendel d) Wallace **Ans: b) Lamarck**

### IX. Two Mark Questions

1. **Define Evolution?**  
Heritable changes in one or more characteristics of a population of a species from one generation to the other.
- 
2. **What does the theory of biogenesis suggest regarding the origin of life?**  
i) Life arose from pre-existing life.  
ii) Biochemical process of production of living organisms.
- 
3. **Name the different methods of food procurement in monera and protista?**  
i) parasitism ii) saprophytism  
iii) predator / animalism iv) Chemosynthesis / Photosynthesis.
- 
4. **Name the organic compounds synthesised in Urey and miller experiment?**  
1. Glycine 2. Alanine 3. Beta alanine  
4. Aspartic acid
- 
5. **What is fossilization?**  
The process by which plant and animal remains are preserved in sedimentary rocks.
- 
6. **Define Palaeontology?**  
The study of prehistoric life through fossils.
- 
7. **How moulds are formed?**  
i) After disintegration, the body of animals leave indelible impressions on the soft mud.  
ii) Later these impressions hardened into stones. These are called moulds.
- 
8. **What do we call as 'casts'?**  
The cavities of the moulds are filled by hard minerals. They get fossilized. They are called casts.

9. **What do you infer from the presence of tail in a human body?**  
i) It is an example for atavistic organ  
ii) It is the appearance of vestigial organs in highly evolved organism.
- 
10. **Suggest the biogenetic law or theory of recapitulation?**  
**Ontogeny recapitulates phylogeny**  
Ontogeny - Life history of an individual.  
Phylogeny - Life history of a race.
- 
11. **Explain molecular clocks with example?**  
➤ Proteins and other molecules that control life process as are conserved among species.  
➤ Slight change that occurs in these conserved molecules are called molecular clocks. (Ex. DNA, RNA and protein molecules)
- 
12. **Suggest the names of a few New Lamarckians?**  
a) Cope b) Osborn c) Packard d) Spencer
- 
13. **Suggest 2 example for the prodigality of production in all living organism?**  
➤ A salmon fish produces 28 million eggs during breeding season.  
➤ Elephant is the slowest breeder. It can produce 6 young ones in its lifetime. It can produce 6 million descendants at the end of 750 years.
- 
14. **Suggest a few New - Darwinians?**  
1) Wallace 2) Haeckel  
3) Mendel 4) Heinrich 5) Weismann
- 
15. **Enlist the 5 basic factors involved in the process of organic evolution?**  
➤ Gene mutation.  
➤ Chromosomal mutation.  
➤ Genetic recombination.  
➤ Natural selection.  
➤ Reproductive isolation.
- 
16. **Define Micro evolution?**  
➤ It is evolution on a small scale.  
➤ It refers to the change in the allele frequencies within a population.
- 
17. **What does geneflow signify?**  
Movement of genes through gametes or movement of individuals in (immigration) and out (Emigration) is called gene flow.

**18. What is Big bang theory?**

It explains the origin of universe as a singular huge explosion in physical term.

**19. Define Neo Darwinism?**

Neo Darwinism is the interpretation of Darwinian evolution through Natural Selection as it has been modified since it was proposed.

**20. State Hardy - Weinberg's law.**

Hardy of UK and Weinberg of Germany stated that the allele frequencies in a population are stable and are constant from generation to generation in the absence of gene flow, genetic drift, mutation, recombination and natural selection.

$$p + q = 1.$$

**21. Differentiate between the eating habit and brain size of Australopithecus and Ramapithecus.**

Australopithecus		Ramapithecus
a) Eating habit	Omnivorous (mainly frugivorous)	Ate hard seeds and nuts like modern man (herbivorous)
b) Brain size	350-450 cc	500 to 600 cc

**22. What is the genetic reason for evolution of Darwin's finches?**

Genetic variation is the ALXI gene in the DNA of Darwin's finches is associated with variation in the beak shape. Mild mutation in the ALXI genes leads to phenotypic changes in the shape of the beak as in Darwin finches.

**23. What is divergent evolution? With example?**

Structures which are similar in origin but perform different functions are called homologous structures that brings about divergent evolution.

**Eg:** Thorn of Bougainvillea, Tendrils of cucurbita are used for climbing.

**X. Three Mark Questions****1. What are the 2 major effects of genetic drift?**

- Bottle neck effect.  
Population size is reduced in size by natural disaster.
- Founder's effect.  
A small group of population splits from the main population to form a new colony.

**2. What is the belief of most religions about the origin of life and evolution of life forms?**

- Life was created by a super natural power called god.
- According to Hinduism, Lord Brahma created the Earth.
- Christianity, Islam and most religions believe that the God created the universe, the plants and animals.

**3. Which part of Geological time scale is called the "Golden age of Reptiles"? Why?**

- Mesozoic era is called the Golden age of reptiles due to the dominance of reptiles.
- It is divided into 3 periods
  - a) **Triassic period.**  
Origin of egg laying mammals.
  - b) **Jurassic period.**  
Dominance of dinosaurs on the earth and fossil bird called Archaeopteryx.
  - c) **Cretaceous period.**  
Extinction of toothed birds, dinosaurs emergence of birds.

**4. Can lamarck's theory be explained on scientific basis? Explain?**

The followers of lamarck explained his theory on a scientific basis. They were Neo lamarckists like cope, Osborn, Packard and spencer.

**Neo Lamarckism theory :**

- Adaptations are universal.
- Organisms acquire new structural adaptation to the changing environmental condition.
- External conditions stimulate somatic cells to produce secretions. These secretions reach the sex cells through blood. It brings variation in the offspring.



**5. What are the 3 ways of the struggle for existence?**

Struggle for food, space and mate exist among the members of the population.

- **Intra specific struggle** Between same species for food, space, mate.
- **Inter specific Struggle** Between different species for food and space.
- **Struggle with environment**  
To cope with the climatic variations, flood, earth quake, draught.

**6. What is Genetic drift?**

- It is a mechanism of evolution.
- The allele frequencies of a population change over generation due to change (sampling error)

**7. Who was the first human like being in the origin and evolution of man?**

- Homo erectus was the first human like being.
- They evolved 1.7 mya.
- They are closer to human in looks, skull was flatter and thicker than modern man.
- Large brain capacity of 900 cc
- They ate meat.

**8. Who were the ancestors of modern Europeans in the evolution of man? Discuss?**

- Cro - Magnon was one of the most talked forms of modern human.
- Their fossils were found from the rocks of Cro - Magnon, France. It is the ancestor of modern Europeans.
- They were adapted for various environmental conditions.
- They were known for cave painting, figures on floors, walls.

**9. Who proved that human beings are superior to other animals?**

- Hominids proved that human beings are superior to other animals.

- Because they were efficient in making tools and culture.
- Their evolution occurred in Asia and Africa.

**10. Comment on Artificial selection?**

- It is by product of human exploitation of forest, oceans and fisheries.
- It is also by the use of pesticides, herbicides and drugs.
- For example from a single species of dog, humans produces new varieties of dogs.

**11. What are 'protobionts'?**

- Abiotically produced molecules.
- They self assemble into droplets. Droplets enclose a watery solution
- They maintain a chemical environment different from surroundings. These spheres are called 'protobionts'

**12. Define coprolites? and write its significance?**

Hardened faecal matter termed as coprolites occur as tiny pellets.

**Significance :** Analysis of the coprolites enables us to understand the nature of diet the pre-historic animals thrived on.

**13. The theory of use and disuse?**

- The organs that are used often will increase in size.
  - And those that are not used will degenerate.
- Example : Use theory :** Neck in giraffe is an example of use.
- Dis use theory :** Absence of limbs in snakes is an example for disuse theory.

**14. What is Adaptive Radiation ?**

The evolutionary process which produces new species diverged from a single ancestral form becomes adapted to newly invaded habitats is called adaptive radiation.

**Ex:** Darwins finches and Australian marsupials

**15. Biogenetic law is not universal give reason.**

The biogenetic law is not universal and it is now thought that animals do not recapitulate the adult stage of any ancestors.

**Example:** The human embryo recapitulates the embryonic history and not the adult history of the organisms.

### XI. Five Mark Questions

- |   |  |
|---|--|
| <p><b>1. Which part of the Geological time scale is called 'The Age of Mammals'? Explain?</b></p> <ul style="list-style-type: none"> <li>➤ Coenozoic era is called as 'The Age of mammals'</li> <li>➤ It has 2 periods Tertiary, Quaternary</li> </ul> <p><b>Tertiary period.</b></p> <ul style="list-style-type: none"> <li>➤ Abundant mammalian fauna.</li> <li>➤ With 5 epochs</li> </ul> <ol style="list-style-type: none"> <li>i) Palaeocene - Placental mammals.</li> <li>ii) Eocene - Monotremes except duckbilled platypus and Echidna, hoofed mammals, carnivores.</li> <li>iii) Oligocene - Appearance of higher placental mammals.</li> <li>iv) Miocene - Origin of first man like apes.</li> <li>v) Pliocene - origin of man from man like apes.</li> </ol> <p><b>Quaternary period.</b></p> <p>Decline of mammals, beginning of human social life.</p> <hr/> <p><b>2. Comparative study of embryos of different animals help as evidence for evolution? Explain?</b></p> <ul style="list-style-type: none"> <li>➤ Animals have close resemblance during embryonic development</li> <li>➤ Heart development in vertebrates indicate a common ancestry for all vertebrates</li> </ul> <ol style="list-style-type: none"> <li>a) Fishes have 2 chambered heart.</li> <li>b) Amphibians have 3 chambered heart.</li> <li>c) Crocodiles, birds and mammals have 4 chambered heart.</li> </ol> <ul style="list-style-type: none"> <li>➤ The biogenetic law or theory of recapitulation was proposed by Von Haeckel. "Ontogeny recapitulates phylogeny"</li> </ul> <p>Ontogeny – Life history of a individual<br/>Phylogeny – Evolutionary history of a race.</p> <p><b>Example :</b> Appearance of gill slits, Yolk sac and tail in human embryos.</p> <ul style="list-style-type: none"> <li>➤ Human embryo recapitulates the embryonic history of the organisms. Not the adult history.</li> <li>➤ Embryos of fish, salamander, tortoise, chick and humans show common ancestry</li> </ul> <p style="text-align: center;">Single cell Zygote <u>cleavage</u> → Blastula →<br/>gastrula → Triploblastic</p> | <p><b>3. Who was the first to postulate the theory of evolution? What was that theory?</b></p> <p>Jean Baptiste de Lamarck was the first to postulate the theory of evolution. It was in his book 'Philosophie zoologique' (1809). The 2 principles of Lamarckian theory are</p> <ol style="list-style-type: none"> <li>i) <b>The theory of use and disuse.</b><br/>Organs often used will increase in size. Organs not used will degenerate.<br/>Example for use - Neck in giraffe.<br/>Example for disuse - Absence of limbs in snakes.</li> <li>ii) <b>The theory of inheritance of acquired characters.</b><br/>characters developed during lifetime of organism are acquired characters. These are then inherited.</li> </ol> <hr/> <p><b>4. Explain the facts (observations, influences) of Darwin's theory?</b></p> <ol style="list-style-type: none"> <li><b>1. Over production (or) prodigality of production.</b><br/>Living organisms increase their population in large number.</li> </ol> <p><b>Examples</b></p> <ol style="list-style-type: none"> <li>a) A salmon fish produces 28 million eggs during breeding season.</li> <li>b) Elephant produces 6 millions descendants in 750 years.</li> </ol> <ol style="list-style-type: none"> <li><b>2. Struggle for existence.</b><br/>Competition or struggle for food, space and mate exists. It is 3 ways</li> </ol> <ol style="list-style-type: none"> <li>a) Intra specific struggle - Between the same species.</li> <li>b) Interspecific struggle - Between the different species.</li> <li>c) Struggle with the environment.</li> </ol> <ol style="list-style-type: none"> <li><b>3. Universal occurrence of variation.</b></li> </ol> <ol style="list-style-type: none"> <li>a) No two individuals are alike.</li> <li>b) Children of same parents differ in colour, behaviour etc.</li> <li>c) Useful variations help to overcome the struggle.<br/>Such variations are passed to next generation.</li> </ol> |
|---|--|

**4. Origin of species by natural selection.**

- Nature is the powerful selective force.
- Struggle for existence resulted in the survival of the fittest.
- Such organisms are better adapted to the changed environment.

**5. How is the distinctive evolutionary relationships of Australian Marsupials and North American placental mammals reflected?**

- Marsupials in Australia and placental mammals in North America are two subclasses of mammals.
- They both have adapted in a similar way to a particular food source, locomotory skill or climate.

3. They were separated from a common ancestor 100 million years ago.

- Each lineage evolved independently.
- Despite temporal and geographical isolation, they produced varieties of species. These species were living in similar habitats with similar ways of life.
- They both resemble in shape, locomotory mode, feeding and foraging. They are superimposed in different modes of reproduction.
- Marsupials undergone adaptive radiation. They occupy diverse habitats in Australia.
- The placental mammals radiated across North America. Thus their evolutionary relationships are reflected.

**ZOOLOGY LONG VERSION QUESTIONS (FOR PURE SCIENCE GROUP)****PART I - TEXT BOOK EVALUATION**

Q.No.1 to 30 Refer Evaluation.

**31. Define isolating mechanism and explain its types with suitable examples.**

Isolation is the separation of the members of a single population into sub populations so that genetic integrity can be maintained.

**1. Ecological isolation or habitat isolation**

The members of the same population may be separated from one another by differences in their habitat. For example *Rana areolata* occupies burrows dug by mammals and tortoises during the day and breeds in grassy shallow ponds whereas species identities.

**2. Seasonal isolation** - In this type of isolation, difference in the breeding seasons prevents interbreeding. E.g. *Toad, Bufo americanus* breeds much early in the spring; whereas *Bufo fowleri* breeds very late in the season.**3. Sexual or ethological isolation/Behavioural isolation** - Prevents mating due to the difference in their sexual behaviour. The species are not separated from one another either in time or in space. The mating calls of two closely related species of frogs, grey tree frog and pine wood tree frog are different.

**4. Morphological isolation or mechanical isolation** - This type of isolation is due to the differences in their external genitalia that is seen in two different species. The size difference between two toad species, prevents their interbreeding.

**5. Physiological isolation** - Though mating may occur, the gametes are prevented from fertilization due to mechanical or physiological factors. E.g. The sperms of *Drosophila virilis* survive only for about a day when introduced into the sperm receptacle of *Drosophila americana*

**6. Cytological isolation [L.V. MAR-2020]**

Fertilization does not take place due to the differences in the chromosome numbers between the two species, the bull frog and gopher frog.

**7. Hybrid Inviability** : The sperm enters the egg, fertilization occurs and the embryo develops into the adult but it dies before reaching maturity. In certain fishes, frogs, beetles.

**8. Hybrid sterility** - Hybrids are formed due to inter specific crosses but they are sterile due to the failure of the chromosomes to segregate normally during meiosis, Eg. Mule (inter specific cross between a horse and a donkey).

**9. Hybrid breakdown** -  $F_1$  Hybrids are viable and fertile, but  $F_2$  hybrids may be inviable or sterile.

32. Define speciation according to A.E. Emerson and explain its types giving suitable examples.

**Speciation :**

**L.V. SEP-2020**

- A.E. Emerson defines species as a 'genetically distinctive, reproductively isolated natural population'.
- Speciation is a fundamental process in evolution.

**Sympatric speciation / Reproductive isolation**

- It is a mode of speciation through which new species form from a single ancestral species while both species continue to inhabit the same geographical region.
- New species formed due to genetic modification in the ancestor naturally selected can no longer breed with the parent population.
- Phenotypic plasticity has emerged speciation initiated within an isolated population.

**Allopatric speciation / Geographical speciation**

- It is a mode of speciation that occurs when biological populations of similar species become isolated from each other that prevents gene flow.
- One species becomes two species due to geographical barriers hence new species is evolved. E.g. Darwin's finches.
- If there are no adaptations, they will not survive, sexual isolation is weakest.
- When the apple trees were imported to North America, Apple maggot flies (*Rhagoletis pomonella*) a parasitic insect laid its eggs in the fruit of domesticated apple trees (*Malus domestica*) that grew in the same area.

33. Give an account on the major causes for the extinction of a particular species on earth.

Major causes for extinction of a species may be natural or due to human Intervention.

**Natural causes :**

1. **Environmental events** - Occurrence of Natural disaster such as floods, volcanic eruptions, etc. can wipe out an entire species.
2. **Biological events** - Non availability of foods, spread of infectious diseases can wipe out a species at large.

**Human Activities :**

- Man is destroying forests in a large scale.
- Modern technology has a major impact for Eg. the sparrow population is said to have reduced due to erection of signal towers built as part of communication. (mobile phones)
- Over exploitation of species for commercial purpose may interfere with food chains and create food deficit for other species.
- The members of particular species appears to be reduced special initiatives have to be taken to conserve the existing individuals and their young ones, breed them and contribute to increasing their members.

34. Explain the three level of impact of extinction of species.

The impact of extinction can be considered at three levels.

- (i) **Species extinction** eliminates an entire species, by an environmental event or by biological event
- (ii) **Mass extinction** eliminates half or more species in a region or ecosystem, by a volcanic eruption. Five major mass extinction that occurred since the Cambrian period. This mass extinction is often referred to as K-T extinction.
- (iii) **Global extinction** eliminates most of the species on a large scale or larger taxonomic groups in the continent or the Earth. Snow ball Earth and extinction following elevation in CO<sub>2</sub> levels are example.

**PART II - ADDITIONAL QUESTIONS****1. What is speciation?**

The process by which one species evolves into one or more different species is called speciation.

**2. Define species according to A.E.Emerson.**

A.E. Emerson defines species as a "genetically distinctive reproductively isolated natural population".

**3. What are the types of species?****Agensis (or) phyletic speciation**

Evolution of a new species in a single lineage.

**Cladogenesis (or) divergent evolution :**

If one species diverges to become two or more species.

**4. Write a short note on sympatric speciation (or) reproductive isolation?**

- A single ancestral species while both species continue to inhabit the same geographical region. Two or more species are involved.
- New species formed due to genetic modification in the ancestor that is naturally selected can no longer breed with the parent population.
- Sexual isolation in strongest phenotypic plasticity has emerged as potentially important first step in speciation initiated within an isolated population.



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EC 12th Bio-Zoology

8. LNG-20 is an IUD which makes the uterus unsuitable and cervix hostile to the sperms as they are:  
**(a) Hormone releasing IUDs** (b) Copper releasing IUDs  
 (c) Plastic made devices (d) Copper made devices
9. ELISA is mainly used for :  
 (a) Detection of mutations **(b) Detection of pathogens**  
 (c) Selecting animals having desired traits (d) Selecting plants having desired traits
10. Who introduced the term "Biodiversity" ?  
 (a) Edward Wilson **(b) Walter Rosen** (c) Norman Myers (d) Alice Norman
11. In the E-waste generated by personal computer, which among the following metal is most abundant ?  
 (a) Copper **(b) Lead** (c) Palladium (d) Tin
12. Hershey and Chase experiment with bacteriophage showed that:  
 (a) Protein gets into the bacterial cells. (b) DNA is the genetic material  
**(c) DNA contains radioactive sulphur** (d) Viruses undergo transformation
13. The most common substrate used in distilleries for the production of ethanol is :  
 (a) Soya meal (b) Ground gram **(c) Molasses** (d) Corn meal
14. Which period was called 'Age of fishes'?  
 (a) Permian (b) Triassic **(c) Devonian** (d) Ordovician
15. What is the sex index of Drosophila, having 3A+XXY chromosomes?  
 (a) 1.5 **(b) 1.0** (c) 0.67 (d) 0.5

**PART - II****Note :** Answer **any six** of the following. Question number **24** is **compulsory**.**6 × 2 = 12**

16. What is bioremediation? **Chap- 8**
17. Mention the differences between spermatogenesis and spermiogenesis. **Chap- 2**
18. What are the three levels of Biodiversity? **Chap- 11**
19. Name the acts which aim at creating a safe and secure environment for both females and males. Add a note on its importance. **Chap- 3**
20. Tabulate the types of malaria with their causative agent. **Chap- 7**
21. What are the characteristics of an ideal contraceptive. **Chap- 3**
22. What is criss-cross inheritance? **Chap- 4**
23. Why do you think it is not possible to produce vaccine against 'common cold'? **Chap- 7**
24. Draw any four symbols commonly used in pedigree charts. **Chap- 4**

**PART - III****Note :** Answer **any six** of the following. Question number **33** is **compulsory**.**6 × 3 = 18**

25. Differentiate relative dating and absolute dating? **Chap- 6**
26. Write short notes on Ideonella Sakaiensis. **Chap- 8**
27. Draw a labelled sketch of human ovum. **Chap- 2**
28. State any three goals of the human genome project. **Chap- 5**
29. Explain how 'Rosie' is different from a normal cow. **Chap- 9**
30. Write the basic features of reproduction. **Chap- 1**

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31. What are the applications of Karyotyping? Chap- 4
32. Explain hibernation and aestivation with examples. Chap- 10
33. How does lactational amenorrhoea serve as a natural birth control method? Chap- 3

**PART - IV****Note :** Answer **all** the questions.**5 × 5 = 25**

34. (a) Explain the process of spermatogenesis with neat schematic sketch. Chap- 2
- OR**
- (b) List any five salient features of genetic code. Chap- 5
35. (a) Describe the origin of life with the experiment by Urey and Miller. Chap- 6
- OR**
- (b) List out the various causes for biodiversity losses. Chap- 11
36. (a) Explain the life cycle of plasmodium in man. Chap- 7
- OR**
- (b) (i) Discuss briefly about Ecosan toilets. Chap- 12
- (ii) What are the remedies for plastic wastes? Chap- 12
37. (a) Explain the formation of nucleosome. Chap- 5
- OR**
- (b) Write the properties of soil in detail. Chap- 10
38. (a) Explain the structure of immunoglobulin with suitable diagram. Chap- 7
- OR**
- (b) What are the applications of PCR? Chap- 9

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# EC BIO-BOTANY & BOTANY

**12**

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This special guide is prepared  
on the basis of New Syllabus  
and Govt. Key

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**Publications**

Vivek Illam, No. 19, Raj Nagar, N.G.O. 'A' Colony,  
Palayamkottai, Tirunelveli - 627 007.

Ph: 0462 - 2553186

Cell: 94433 81701, 94422 69810, 90474 74696

81110 94696, 89400 02320, 89400 02321

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**Authors:**

**Mrs. Helen Cronans**

**Dr. A.T. Jai Prasadh**

**Mr. Daniel Rajan Hubert**

**Mr. Saravanan**

**Mrs. Vijayarani**

**Mrs. Jothi Nirmala**

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**Publications**

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# PREFACE

Dear Students

- XIIth Bio-Botany book has been made EC - bearing in mind the needs and grasping power of the students.
- The subject matter given is simple, lucid and self - explanatory.

## **SPECIAL FEATURES OF THE BOOK**

- This guide has been framed based on the New 100 marks pattern
- Theory based pattern for 70 marks.

**Additional MCQS,VSA, SA, LA questions with answer are given in each unit.**

- Every chapter has its technical terms, exhaustive one mark questions and simplified diagrams.
- Answers include 'key points' to be taken into account during public exam paper valuation.
- Other than textual questions enough additional questions with the right answers are given.
- This guide is prepared in a special way that students can study for both 12th Govt. Exams and NEET Exams.

## **TIPSTO GET CENTUM IN BIO-BOTANY**

- Use memory techniques
- Read - study, recall and revise systematically so as to store it in the LTM (Long Term Memory) file.
- Above all learn thoroughly with involvement.

Enclosing prayers and wishes

**LOYOLA PUBLICATIONS**

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## Botany

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# Reproduction in Plants

## Asexual and Sexual Reproduction in Plants

### Part - I - TEXTBOOK EVALUATION

1. Choose the correct statement from the following
- Gametes are involved in asexual reproduction
  - Bacteria reproduce asexually by budding
  - Conidia formation is a method of sexual reproduction
  - Yeast reproduce by budding
- Ans : d) Yeast reproduce by budding**
- 
2. An eminent Indian embryologist is
- S.R.Kashyap
  - P.Maheswari
  - M.S. Swaminathan
  - K.C.Mehta
- Ans : b) P.Maheswari**
- 
3. Identify the correctly matched pair
- Tuber-Allium cepa
  - Sucker - Pistia
  - Rhizome-Musa
  - Stolon - Zingiber
- Ans : c) Rhizome - Musa**
- 
4. Size of pollen grain in *Myosotis*
- S.V. GMQ-19, L.V-Aug-21**
- 10 micrometer
  - 20 micrometer
  - 200 micrometer
  - 2000 micrometer
- Ans : a) 10 micrometer**
- 
5. First cell of male gametophyte in angiosperm is
- S.V. May-22, L.V-May-22**
- Microspore
  - megaspore
  - Nucleus
  - Primary Endosperm Nucleus
- Ans : a) Microspore**

6. Match the following

I)	External fertilization	i)	pollen grain	a)	I-iv;II-i;III-ii;IV-iii
II)	Androecium	ii)	anther wall	b)	I-iii;II-iv;III-i;IV-ii
III)	Male gametophyte	iii)	algae	c)	I-iii;II-iv;III-ii,IV-i
IV)	Primary parietal layer	iv)	stamens	d)	I-iii;II-i;III-iv;IV-ii

**Ans : b) I-iii;II-iv;III-i;IV-ii**

7. Arrange the layers of anther wall from locus to periphery
- Epidermis, middle layers, tapetum, endothecium
  - Tapetum, middle layers, epidermis, endothecium
  - Endothecium, epidermis, middle layers, tapetum
  - Tapetum, middle layers endothecium epidermis
- Ans : d) Tapetum, middle layers endothecium epidermis**
- 
8. Identify the incorrect pair. **L.V. GMQ-19**
- sporopollenin - exine of pollen grain
  - tapetum - nutritive tissue for developing microspores.
  - Nucellus - nutritive tissue for developing embryo
  - obturator - directs the pollen tube into micropyle
- Ans : c) Nucellus - nutritive tissue for developing embryo**
- 
9. Assertion : Sporopollenin preserves pollen in fossil deposits.  
Reason : Sporopollenin is resistant to physical and biological decomposition.
- Assertion is true; reason is false
  - Assertion is false; reason is true
  - Both Assertion and reason are not true
  - Both Assertion and reason are true
- Ans : d) Both Assertion and reason are true**

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EC 12<sup>th</sup> Bio-Botany

10. 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 and d) ovules have single layer of nucellus tissue

11. Which of the following represent megagametophyte

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

Ans : b) Embryo sac

12. In *Haplopappus gracilis*, number of chromosomes in cells of nucellus is 4. What will be the chromosome number in Primary endosperm cell? **L.V. Aug 22**

- a) 8      b) 12      c) 6      d) 2

Ans : C) 6

13. Transmitting tissue is found in

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

Ans : c) Stylar region of gynoecium

14. The scar left by funiculus in the seed is

- a) tegmen      b) radicle **L.V. May 22**  
 c) epicotyl      d) hilum

Ans : d) hilum

15. 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

16. 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 flowers  
 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

17. Coelorrhiza is found in **S.V. Aug 22, L.V. Aug 22**

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

Ans : a) Paddy

18. Parthenocarpic fruits lack

**S.V. AUG-2021**

- a) Endocarp      b) Epicarp  
 c) Mesocarp      d) seed

Ans : d) seed

19. 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

20. What is reproduction?

- It is a vital process for the existence of a species.
- It brings suitable changes through variation in off springs.
- Plant reproduction is important for the existence of all other organisms.

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

Sub - aerial stem modifications.

The stem is partly aerial and partly underground.

- a) Runner. (Ex. oxalis, centella asiatica)  
 b) Sucker. (Ex. Musa (banana), chrysanthemum)  
 c) Stolon (Ex. Strawberry, vallisneria)  
 d) Offset (condensed runners)

22. What is layering?

- It is an artificial method of vegetative propagation.
- Stem of the parent plant is allowed to develop roots while still intact.
- The root develops. The rooted part is cut. It is planted to grow as a new plant.
- Ex. Ixora, Jasminum.

23. What are clones?

- The individuals (Ex. Bacteria) formed by asexual reproduction are morphologically and genetically identical.
- They are called clones.

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

- *Bryophyllum* can be reproduced by vegetative propagation by using piece of its stem or leaves.
- The leaves of a *Bryophyllum* plant have special buds with notches called epiphyllous buds in their margins which may get detached from the leaves, fall to the ground and then grow to produce a new plant.

## 25. Differentiate Grafting and Layering.

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

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

- The growth of plant tissue in special culture medium under suitable controlled conditions is known as "tissue culture".
  - It is the regeneration of whole plant from a single cell or tissue.
- Advantages.**
- Rare, Endangered plants are propagated.
  - In short duration, plants with desirable characteristics can be multiplied.
  - Produce Genetically identical plants.
  - Done in any season.
  - Plants without viable seeds (or) difficult to germinate can be propagated.
  - Meristem culture produces disease free plants.
  - Cells can be genetically modified or transformed.

## 27. Distinguish mound layering and air layering.

	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.	Hormones are not required to promote rooting.	Hormones are applied to promote rooting.
4.	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.

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

Conventional methods of vegetative propagation.

## a) Cutting (Ex. Hibiscus)

- Plant parts like stem, leaf are cut from the parent plant.
- Cut part is placed in suitable medium.
- It produces root and grows into new plant.

## b) Grafting (Ex. Citrus, Mango)

- Two different plants are joined.
  - They grow as one plant.
  - Plant in soil is called stock.
  - Plant used for grafting is scion.
  - It is of 5 types.
- i) **Bud grafting** - scion is placed in incision of stock.
  - ii) **Approach grafting** - Cut surfaces of stock scion are tied together.

- iii) **Crown Grafting** - Wedge shaped scion is inserted to cleft of stock.
- iv) **Tongue grafting** - Stock and scion are cut obliquely scion is fit into stock and bound with tape.
- v) **Wedge grafting** - Twig of scion is inserted into slit in the stock.
- c) **Layering**
- Stem of parent plant is allowed to develop roots while still intact.
  - The root develops. The rooted part is cut and planted to grow as a new plant.
- I) **Mound Layering**
- Flexible branch is buried in soil.
  - Roots emerge from buried stem. It grows into a new plant.
- ii) **Air Layering**
- Nodal region is girdled.
  - Hormones are applied.
  - Rooting is promoted.
  - This area is covered by moist soil.
  - Roots emerge in 2-4 months.
  - Roots branches are removed from parent. They are grown separately.

### 29. What is Cantharophily?

- The cross pollination of flowers by beetles is called cantharophily. The beetles feed the pollen or on some of the juicy tissues of the flowers.
- The plants using this mode of pollination
- **Ex.** Nymphaea species of plants - Rhinoceros beetle.
- Giant Waterlily - Scarab beetle
- Illicium plant - Diptera flies.

### 30. List any two strategy adopted by bisexual flowers to prevent self-pollination.

#### 1) Dichogamy

Anthers and stigmas mature at different times.

- Protandry - Stamens mature earlier.
- Protogyny - Stigmas mature earlier.

#### 2) Herkogamy

- Self pollination is impossible by the arrangement of stamens and stigmas.
- **Ex:** In Hibiscus, stigmas project above the stamens.

- In some plants, when the pollen grain of a flower reaches the stigma of the same.
  - It is unable to germinate or prevented to germinate on its own stigma.
  - It is a genetic mechanism.
- Example : Abutilon, parsiflora.

### 31. What is endothelium? **L.V-Aug-21** **L.V-May-22**

- It is otherwise known as integumentary tapetum.
- In some species, the inner layer of integument may become specialized to perform nutritive function for the embryo sac and is called endothelium.

**Eg. Asteraceae.**

### 32. "The endosperm of angiosperm is different from gymnosperm". Do you agree. Justify your answer. **S.V.GMQ-19**

**Yes: I agree**

Endosperm of Angiosperms	Endosperm of Gymnosperm
➤ It is formed after fertilization	➤ It is formed before fertilization.
➤ It is triploid tissue.	➤ It is a haploid tissue.
➤ The function is to nourish the developing embryo.	➤ It acts as the female gametophyte and later acts as nutritive tissue.

Thus the endosperm tissue is different in Angiosperms and Gymnosperm.

### 33. Define the term Diplospory.

- A diploid embryo sac is formed from megaspore mother cell without a regular meiotic division.
- Examples : Eupatorium and Aerva.

### 34. What is polyembryony. How it can commercially exploited. **S.V. SEP-2020**

#### Polyembryony.

- Occurrence of more than one embryo in a seed is called polyembryony.

#### Practical Applications.

- Seedlings from nucellar tissue of citrus are better clones for orchards.
- Embryos from polyembryony are virus free.

35. Why does the zygote divides only after the division of Primary endosperm cell.

- The Zygote needs nourishment during its development.
- Fertilised embryo sac offers little nourishment to the Zygote.
- The primary endosperm cell divides and generates endosperm tissue. This nourishes the Zygote. So, the Zygote divides after primary Endosperm cell.

36. What is Mellitophily? **S.V. May - 22**

- Pollination of flowers by bees is known as mellitophily.
- It is a type of cross - pollination by biotic agencies like bees.

37. "Endothecium is associated with dehiscence of anther" Justify the statement.

- Endothecium is a single layer of radially elongated cells below the epidermis of anther wall.
- The inner tangential wall develops bands or thickenings of  $\alpha$  cellulose.
- The cells at the junction of two sporangia of an anther lobe lacks thickening and this region is called
- Stomium along with the hygroscopic nature of endothecium helps in the dehiscence of anther at maturity.

38. List out the functions of tapetum. Tapetum is the innermost layers of anther wall. **S.V. May 22, L.V. May 22**

- Supplies nutrition to developing microspores.
- Contributes sporopollenin through ubisch bodies. They play role in pollen wall formation.
- Pollenkitt material is contributed by tapetal cells. It is a layer transferred to pollen surface.
- Exine proteins for rejection reaction are derived from tapetal cells.

39. Write short note on Pollen kitt.

- Pollen kitt is an oily layer on pollen surface. It is a viscous coating.
- It is contributed by tapetum.
- It is coloured yellow or orange.
- It is made of carotenoids, flavinoids.
- It attracts insects.
- It protects from damage by Uv radiation.

40. Distinguish tenuinucellate and crassinucellate ovules.

Tenuinucellate ovule	Crassinucellate ovule.
➤ The sporogenous cell is hypodermal	➤ These ovules have sub-hypodermal sporogenous cell
➤ It has single layer of nucellar tissue.	➤ Many layers of cells are seen.
➤ It has very small nucellus.	➤ They have large nucellus.

41. 'Pollination in Gymnosperms is different from Angiosperms' - Give reasons. **L.V-GMQ-21**

- Pollination in gymnosperms is direct.
  - The pollens are deposited directly on the exposed ovules.
- Angiosperms :**
- In Angiosperms it is indirect.
  - The pollens are deposited on the stigma of the pistil.

42. Write short note on Heterostyly.

- It is a contrivance of cross - pollination.
- Some plants produce two or three different forms of flowers that are different in their length of stamens and style.
- Pollination will take place only between organs of the same length.

a) **Distyly**

- The plant produces two forms of flowers, Pin or long style long stigmatic papillae, short stamens and small pollen grains.
- Thrum - eyed of short style, small stigmatic papillae long stamens and large pollen grains.

Example: *Primula*



b) **Tristyly (Ex. Lythrum)**

- Three kinds of flowers are there, with respect to the length of style and stamens.
- Flower of one type can't pollinate their own type. They pollinate other 2 types.

**43. Enumerate the characteristic features of Entomophilous flowers.**

- Flowers are generally large or if small, they are aggregated in dense inflorescence.  
Ex: Asteraceae flowers.
- Flowers are brightly coloured to attract insects.  
Ex : *Poinsettia* and *Bougainvillea*.
- Flowers are scented and produce nectar.
- Flowers with no secretion of nectar, the pollen is consumed as food or used in building up of its hive by honey bees. Pollen and Nectar are the floral rewards for the visitors.
- Flowers pollinated by flies and beetles produce foul odour to attract insects.
- Juicy cells are pierced and the contents are sucked by the insects.

**44. Discuss the steps involved in Microsporogenesis.**

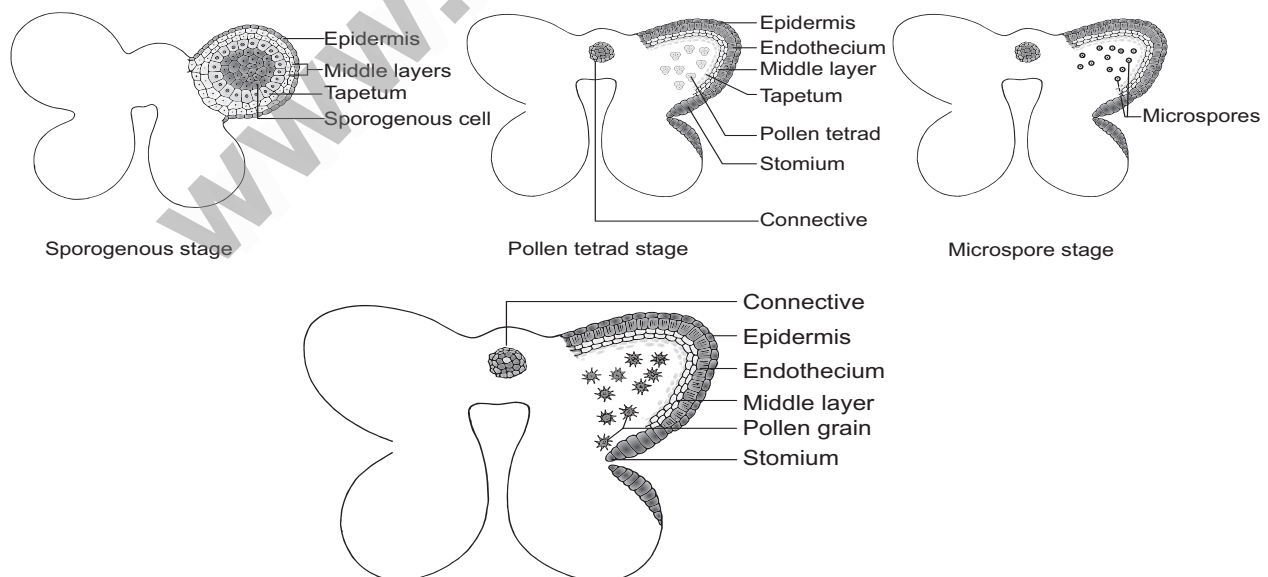
S.V.Aug-21

**Microsporogenesis.**

Formation of haploid microspores from diploid microspore mother cell through meiosis is called **Microsporogenesis**.

- The primary sporogeneous cells undergo mitotic to form **sporogenous tissue**.
- The last generation of sporogenous tissue function as microspore mother cells.
- Each microspore mother cell divides meiotically to form a tetrad of four haploid microspores (microspore tetrad).
- Arrangement of microspore tetrad tetrahedra, decussate, linear, T shaped or isobilateral manner are 4 haploid microspore.
- Microspores separate from one another and remain free in the anther locule and develop into pollen grains.
- In some plants, all the microspores in a microsporangium remain held together called pollinium.

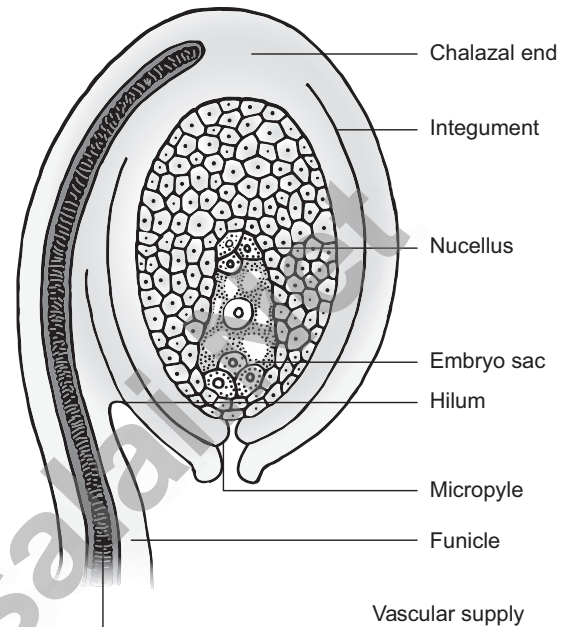
**Example:** Calotropis, Compound pollen grains are found in *Drosera* and *Drymis*.



45. With a suitable diagram explain the structure of an ovule. L.V. S.V.GMQ -19 S.V.Aug-21 L.V. Aug -22

### Structure of ovule (Megasporangium)

- Ovule is also called megasporangium.
- It has a stalk and a body.
- Stalk (funiculus) is at the base of ovule. It attaches ovule to the placenta.
- Hilum is the junction (point of attachment) between ovule and funicle.
- In an inverted ovule, the funicle is fused to the body of ovule. Thus a ridge called raphe is formed.
- Body of ovule has central mass of reserve food called nucellus.
- Nucellus is covered by 2 layers. called integuments.
- Integument covers the nucellus completely except at the top.
- This forms a pore called micropyle.
- Ovule with single integument is called unitegmic.
- At the base of body, nucellus, integument and funicle meet. This is called chalaza.
- Sac like structure in nucellus towards micropylar end is called embryosac (or) female gametophyte. It is formed from functional megaspore of nucellus.
- The nutritive inner intergumentary layer is called integumentary tapetum or endothelium.
- Tenuinucellate type ovule has hypodermal sporogenous cell. It has single layer of nucellar tissue.
- Crassinucellate type, ovule has subhypodermal sporogenous cell.
- Group of cells between chalaza and embryosac is called hypostase.
- Thick walled cells above micropyle are called **epistase**.



46. Give a concise account on steps involved in fertilization of an angiosperm plant.

The fusion of male and female gamete is called fertilization

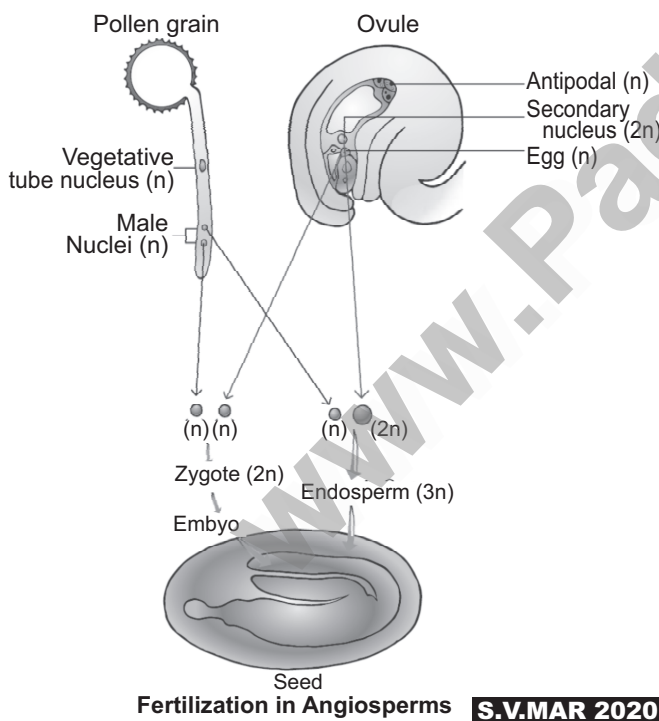
### Steps in the fertilization

- (i). Germination of pollen to form pollen tube in the stigma
- (ii). Growth of pollen tube in the style
- (iii). Direction of pollen tube towards micropyle of ovule.
- (iv). Entry of the pollen tube into embryo sac.
- (v). Discharge of male gametes.
- (vi). Syngamy
- (vii). Triple fusion

1. Germination of pollen to form pollen tube in the stigma.

- Pollens fall on receptive stigma.
- Compatible pollen germinates to form tube.
- This is helped by stigmatic fluid in wet stigma and pellicle in dry stigma.
- Compatibility is decided by recognition, rejection protein reaction, between pollen and stigma surface.

- Pollen undergoes hydration. Pollen wall proteins are released.
  - The entire content moves into pollen tube.
  - Growth is at the cytoplasmic contents at the tip.
  - Remaining part of pollen tube is occupied by vacuole.
  - It is cut off from tip by callose plug.
  - The hemispherical, transparent pollen tip of pollen tube is called 'cap block'. The "cape block" disappears and growth of pollen tube stops.
- 2. Growth of pollen tube in the style.**
- Hollow style glandular canal cells secrete mucilaginous substance.
  - These secretions are nutrition for growing pollen tube.
  - They control compatibility of style and pollen tube.
  - In solid style the pollen tube grows through intercellular space of transmitting tissue.
  - Semisolid style is intermediate between solid and open type.



### 3. Entry of pollen tube into the ovule.

- Progamy - Pollen tube enters through micropyle.
- Chalazogamy - Pollen tube enters through chalaza.

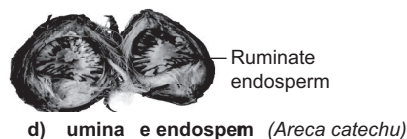
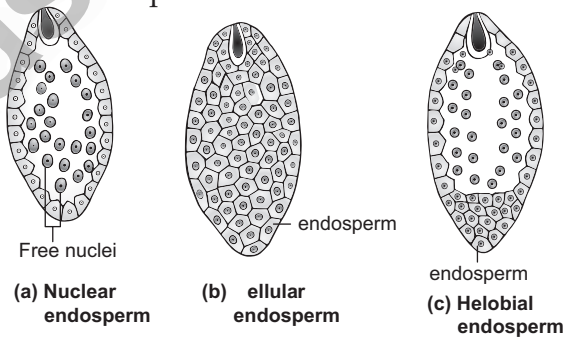
- Mesogamy - Pollen tube enters through integument.
- 4. Entry of pollen tube into embryo sac.**
- Pollen tube enters embryosac at the micropylar end.
  - It is guided by obturator.
  - Pollen tube enters into one of the synergids.
- 5. Double fertilization and Triple fusion.**
- In Angiosperms, both the male gametes are involved in fertilization, it is called double fertilisation.
  - One of the male gametes fuses with the egg nucleus (syngamy). Thus zygote is formed.
  - The second gamete migrates to central cell.
  - It fuses with polar nuclei (or) secondary nucleus.
  - Thus primary Endosperm nucleus is formed.
  - This involves the fusion of 3 nuclei so it is called Triple fusion.

### 47. What is endosperm. Explain the types.

#### Endosperm:

**L.V. SEP-2020**

Endosperm is a nutritive tissue in seed plants formed within the embryo sac by division of the endosperm nucleus.



#### 1. Nuclear Endosperm:

- Primary Endosperm Nucleus undergoes several **mitotic divisions** without cell wall formation thus a **free nuclear condition** exists in the endosperm.

Eg: *Coccinia, Capsella and Arachis*

#### 2. Cellular endosperm:

- Primary endosperm nucleus divides into 2 nuclei and it is immediately followed by **wall formation**.

- Subsequent divisions also follow cell wall formation.
- **Eg:** *Adoxa, Helianthus and Scoparia.*

### 3. Helobial endosperm:

- Primary endosperm nucleus moves towards base of embryo sac and divides into two nuclei.
- Cell wall formation takes place leading to the formation of a large micropylar and small chalazal chamber.
- The nucleus of the micropyla chamber undergoes several free nuclear division whereas that of chalazal chamber may or may not divide.
- **Eg:** *Hydrilla and Vallisneria*

### 4. Ruminant endosperm:

- The endosperm with irregularity and unevenness in its surface forms ruminant endosperm.
- Examples :Areca catechu, Passiflora and Myristica

### 48. Differentiate the structure of Dicot and Monocot seed.

Structure of Dicot seed.	Structure of Monocot seed.
1 Two cotyledons	Only one cotyledon
2. Two seeds may be seen	Paddy is one seeded.
3. The seed coat has outer coat testa and inner tegmen.	Seed is enclosed by husk. The brown membranous seedcoat is closely adhered to grain.

4. In pea the cotyledons store the food. In castor the endosperm stores reserve food.	Suctellum supplies embryo with food from endosperm through epithelium
5. Coleoptile (sheath of plumule) coleorhiza (sheath of radicle) are absent.	Coleoptile and coleorhiza are seen.

### 49. Give a detailed account on parthenocarpy. Add a note on its significance.

**L.V. MAR-2020**

#### 1. Parthenocarpy

**L.V. Aug -21 L.V. Aug -22**

**S.V. May 22**

Development of fruit like structures from the ovary without fertilization. These fruits are parthenocarpic fruits. They have no true seeds. Commercially they are seedless fruits.

#### Genetic Parthenocarpy (Ex. Citrus)

- Due to hybridization, Mutation. Ex : Citrus, Cucurbita

#### Environmental Parthenocarpy

- Environmental condition induces parthenocarpy. Ex) Low temperature for 3-19 hours.

#### Chemically Induced Parthenocarpy.

- Growth promoting Auxins, Gibberellins induce parthenocarpy.

#### Significance

- Significance of seedless fruits in horticulture.
- Commercial Importance
- To prepare jam, jelly, sauce, fruit drinks.
- High proportion of edible part due to absence of seed.

## Part - II - PTA & GOVT EXAM QUESTION & ANSWERS

### I. Match the following

1.

**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

Choose the correct options from the codes given below:

- |     | 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**

### II. Choose the correct answer.

- Which one of the following is not an advantage of micro propagation? **PTA-1**
  - Plants produced are genetically identical
  - Endangered plants can be propagated
  - Sometimes undesirable genetical changes occur
  - Disease free plants can be produced.

Ans : c) Sometimes undesirable genetical changes occur
- Which one of the following statements is not true regarding sporopollenin? **PTA-2**
  - Sporopollenin is contributed by both pollen cytoplasm and tapetum
  - It helps the pollen to withstand against strong acid.
  - Sporopollenin is derived from phycobilins
  - It helps pollen during long period perservation in fossil deposits

Ans: c) Sporopollenin is derived from phycobilins
- Continuous variation is due to **PTA-3**
  - effect of polygenes
  - effect of environment
  - effect of polygenes and environment
  - effect of one or to genes

Ans: c) effect of polygenes and environment
- In a male gametophyte, the chromosome number of generative nucleus is (A) and tube nucleus is (B) **PTA-4**
  - (A)-(n) ; (B)-(2n)
  - (A)-(2n) ; (B)-(n)
  - (A)-(2n) ; (B)-(2n)
  - (A)-(n) ; (B)-(n)

Ans : b) (A)-(2n) ; (B)-(n)
- Which one of the following is a dioecious plant? **PTA-5**
  - Coconut
  - Bitter gourd
  - Pea plant
  - Date palm

Ans : d) Date palm
- Eyes of potato refers to
  - adventitious roots
  - axillary buds
  - terminal buds
  - intercalary buds

Ans : b) axillary buds

- Identify the type of embryo state
  - Zygote
  - Globular embryo
  - Mature embryo
  - 4 celled embryo

Ans : b) Globular embryo
- First cell of Male gametophyte in angiosperms is **S.V. MAR-2020**
  - Primary endosperm
  - Microspore
  - Megaspore
  - Nucleus

Ans : b) Microspore
- From the following which one is the column of sterile tissue surrounded by the anther lobe. **L.V. MAR-2020**
  - Periplasodium
  - pollen chamber
  - connective tissue
  - tapetum

Ans : c) connective tissue
- Cantharophily is **L.V. Sep-21**
  - Bees
  - Butterflies
  - Flies
  - Beetles

Ans : d) Beetles

### III. Two Mark Questions

- Mention the names of the matured pollen grain wall layers? **L.V. GMO-19**
  - Anther wall
 

The mature anther will consists of the following layers.

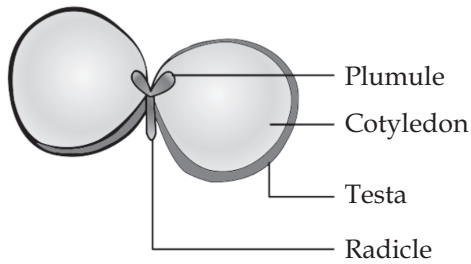
    - Epidermis
    - Endothecium
    - Middle layers
    - Tapetum
- Differentiate biosporic megaspore development from tetrasporic development. **PTA-1**

	Biosporic megaspore development	Tetrasporic development
1.	Of the four megaspores formed two are involved in Embryo Sac formation. The development is called bisporic.	All the four megaspores are involved in Embryo Sac formation. The development is called tetrasporic.
2.	Example: <i>Allium</i>	Example: <i>Peperomia</i>

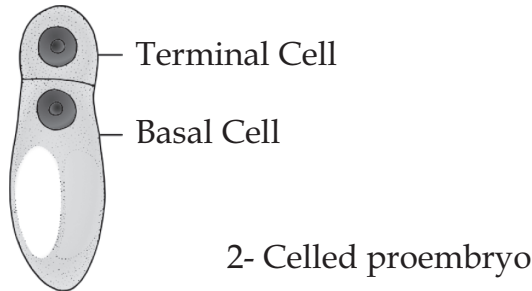
Loyola

EC 12<sup>th</sup> Bio-Botany

3. Draw this diagram and lable the parts. **PTA-3**



4. Redraw the diagram and lable the parts. **PTA-4**



2- Celled proembryo

5. Which method of artificial vegetative reproduction is good in plants? Give reason for your answer. **PTA-4**

- Different plants can be propagated by different method of artificial vegetative propagation.
- The method used depends on type of plant, response of plant, economic reasons etc.
- Therefore no specific method is said to be best.
- Both conventional and modern methods here advantages and disadvantages. Eg.: Cutting, layering grafting etc.

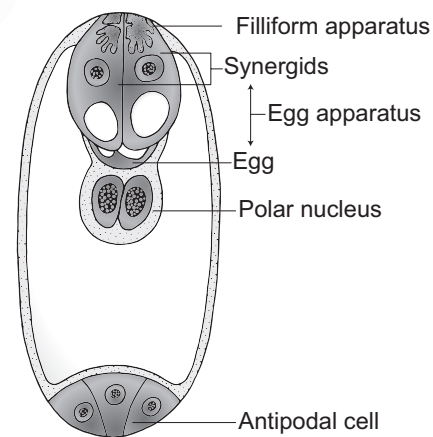
6. Write the practical application of activation of nucellar tissue. **PTA-5**

- The activation of nucellar tissue or any other cells (sporophytic cells of the ovule) can produce more than one embryo, known as poly embryony.
- The seedlings formed from the nucellar tissues in citrus are found better clones for orchards.
- They are Disease resistant (virus free) and are preferred by Agriculturists than the normal seedlings.

7. Write any two differences between male gametophyte and female gametophyte. **PTA-6**

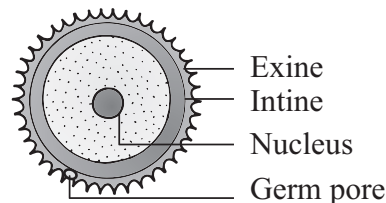
	Male gametophyte	Female gametophyte
1.	It is the pollen grain (microsporangium)	It is embedded inside the ovum (megaspore)
2.	It has two phases of growth - pre pollination and post pollination. Pre pollination occurs in it.	All the cells are formed in single phase of growth surrounded by megaspore membrane.
3.	It is only 3 celled. All cells of it are functional	It is 7 celled and the growth occurs inside megaspore

8. Draw and label the structure of Embryo sac. **HY - 2019 L.V.May 22 L.V.Aug 22**



Structure of Embryo sac

9. Draw and mark the part of first cell of male gametophyte. **S.V. SEP-2020**



Microspore- the first cell of the male gametophyte

#### IV. Three mark Questions

#### 1. Differentiate Heterostyly from Herkogamy.

PTA-2

	Heterostyly	Herkogamy
1.	Some plants produce two or three different forms of flowers that are different in their length of stamens and style	Stamens and stigmas are arranged in such a way preventing self pollination.
2.	Pollination will take place only between organs of the same length. Distyly: Eg. Primula	Stigmas project for above the stamens Eg: Hibiscus

#### 2. How does pollen tube grow through a solid style?

PTA-3

- It is common among dicots. It is characterized by the presence of central core of elongated highly specialised cells called transmitting tissue.
- This is equivalent to the lining cells of hollow style and does the same function.
- Its contents are also similar to the content of those cells. The pollen tube grows through inter-cellular spaces of the transmitting tissue.

#### 3. Grafting is a method of production of hybrid plants but not the method of reproduction. Do you agree this statement? Give logic reason for your answer.

PTA-4

- Eventhough Grafting is considered as artificial method of vegetative reproduction, it is really used to produce plants combining favourable stem characteristics with root characteristics.
- The stem of the plant to be grafted is known as scion and the root is called stock.

- Here, one hybrid is produced unlike in other method where many number of plants are produced.

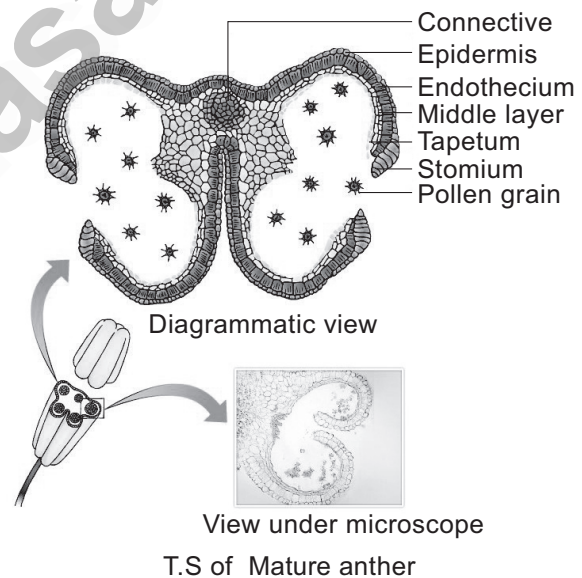
#### 4. Write the three fusion of Antispermous plant fertilization.

PTA-6

- One of the male gametes fuses with the egg nucleus (syngamy) to form Zygote.
- The second gamete migrates to the central cell where it fuses with the polar nuclei or their fusion product, the secondary nucleus and forms the primary endosperm nucleus (PEN)
- Since this involves the fusion of three nuclei, this phenomenon is called triple fusion.

#### 5. Draw the lable the T.S of mature anther:

S.V. QY -19 L.V. MAR-20 L.V. Aug -21



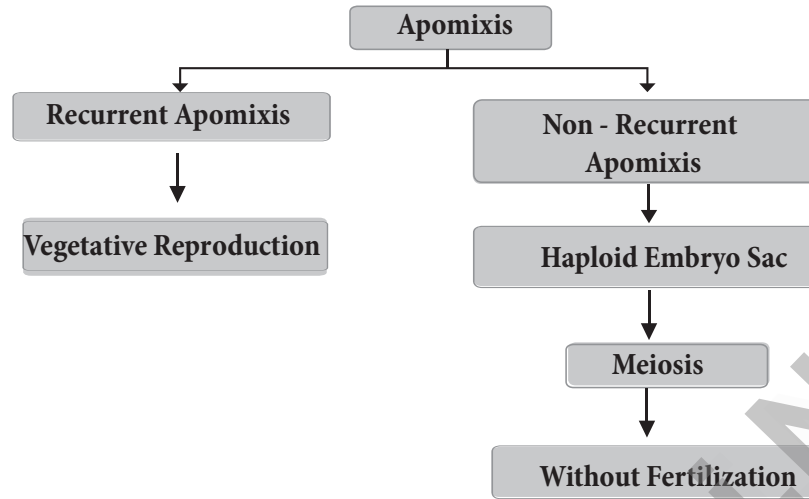
#### 6. What is the process of micropropagation?

QY -2019

- The regeneration of a whole plant from single cell, tissue or small pieces of vegetative structures through tissue culture is called micropropagation
- This is one of the modern methods used to propagate plants.

## V. Five Mark Questions

1. A reproduction without the involvement of male and female gametes is called apomixis. Give an outline of the method. **PTA-2**



2. Enumerate the characteristic features of Anemophilous Plants. **PTA-3 S.V. Aug -22**

- Flowers in pendulous, catkin like, spike inflorescence.
- Inflorescence axis elongates. So, flowers are brought above leaf level.
- Reduced perianth (or) Absent.
- Small, colourless flowers do not / secrete nectar. They are not scented.
- Long, exerted, versatile filaments.
- Enormous quantity of pollen grains.
- Minute, light, dry pollen easily carried by wind to long distances.
- Violent bursting of anthers release the pollengrains. Ex. Urtica.
- Protruding, feathery, branched stigma catch pollengrains.
- Flowers are produced before leaves. So, they are carried without hindrance.

3. Describe the structure of dicot seed **PTA-5**  
Structure of a Cicer seed as an example for Dicot seed :

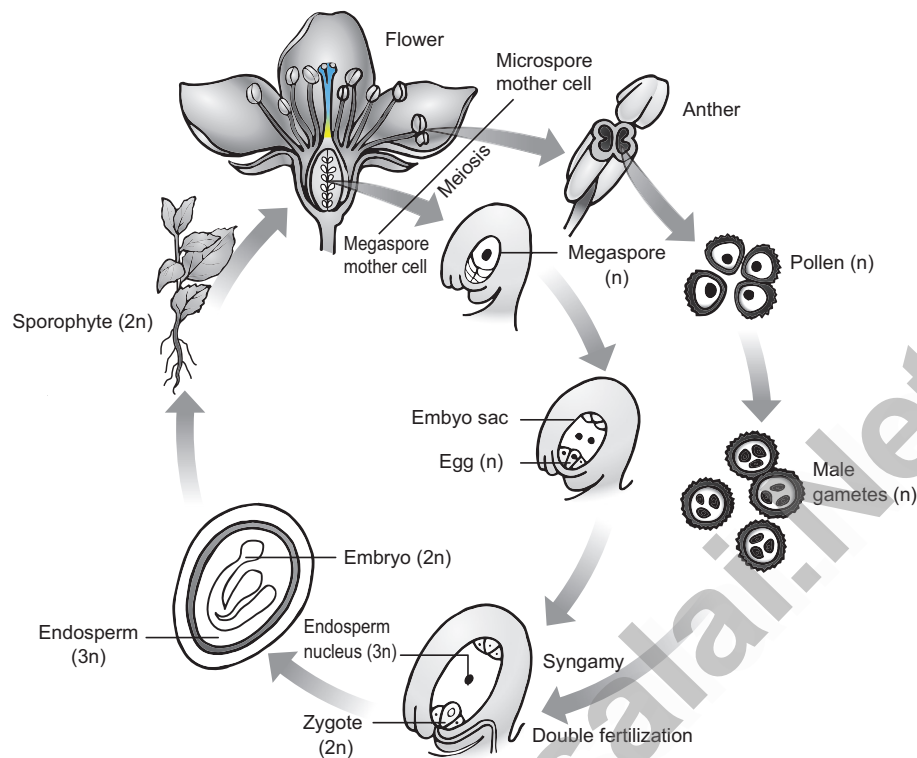
- The mature seeds are attached to the fruit wall by a stalk called funiculus.
- The funiculus disappears leaving a scar called hilum.
- Below the hilum a small pore called micropyle is present.

- It facilitates entry of oxygen and water into the seeds during germination.
- Each seed has a thick outer covering called seed coat.
- The seed coat is developed from integuments of the ovule.
- The outer coat is called testa and is hard whereas the inner coat is thin, membranous and is called tegmen.
- In Pea plant, the tegmen and testa are fused.
- Two cotyledons laterally attached to the embryonic axis are present.
- It stores the food materials in pea whereas in other seeds like castor the endosperm contains reserve food and the cotyledons are thin.
- The embryonal axis projecting beyond the cotyledons is called radicle. The other end of the axis called embryonic shoot is the plumule.
- Embryonal axis above the cotyledon is called epicotyl. The cylindrical region between the level of cotyledon is called hypocotyl.
- The epicotyl terminates in plumule, the hypocotyl ends in radicle.



4. Summarise the whole life cycle of an Angiosperm plant in the form of schematics diagram.

PTA-6

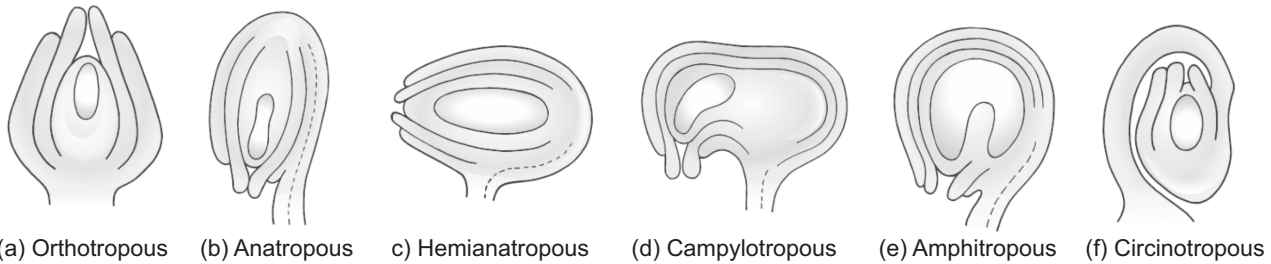


5. Explain the different types of ovule with suitable diagram

L.V. MAR-2020

- 1) **Orthotropous**
  - Micropyle is at distal end.
  - Funicle and chalaza lie in one straight vertical line (Ex. Piperaceae)
- 2) **Anatropous**
  - Body of ovule is inverted.
  - Micropyle, funiculus lie close to each other Ex. Dicots, Monocots.
- 3) **Hemianatropous**
  - Body is transverse
  - It is at right angle to funicle.  
Ex. Primulaceae.
- 4) **Campylotropous**
  - Body is curved at micropylar end.
  - Embryosac is curved.
  - Hilum, micropyle and chalaza are nearer. Ex. Leguminosae
- 5) **Amphitropous**
  - Less distance between hilum and chalaza.
  - Nucellus is horse shoe shaped.  
Ex. Alismataceae.
- 6) **Circinotropous. (Ex. Cactaceae)**
  - Long funicle surrounds the ovule.

S.V. Aug 22



### 6. Elaborate an account on the T.S of anther.

#### 1. Anther Wall

L.V. MAR-2020

##### a) Epidermis

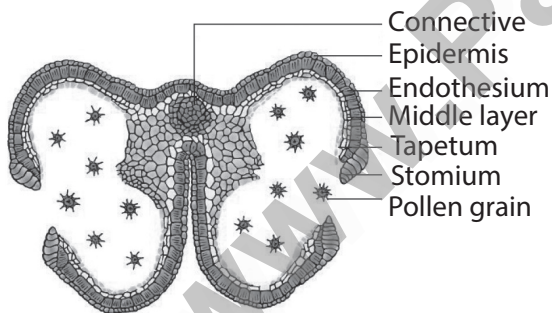
- Protective single layer.
- Cells undergo anticlinal division to cope up enlarging internal tissue.

##### b) Endothecium

- Single layer of radially elongated cells.
- Bands of cellulose (or) lignin are seen in tangential wall.
- At the junction of 2 sporangia these thickenings are absent. This region is called stomium.
- Hygroscopic nature of endothecium helps in dehiscence of anther.

##### c) Middle layer

- 2 to 3 layers next to endothecium.
- These are ephemeral. Disintegrate or crushed during maturity.



#### d) Tapetum

L.V. May-22

- It is dual in origin (from peripheral wall layer and connective tissue of anther lining.)
- It nourishes sporogenous tissue, microspore mother cell, microspores.
- Cells are uninucleate, multinucleate with polyploid nucleus.
- It contributes to wall material, sporopollenin, pollenkit, tryphine.
- It controls fertility or sterility of pollengrains.
- It is of 2 types i) Secretory tapetum ii) Invasive tapetum.

#### 2. Anther cavity.

- It is filled with young microspores or mature pollengrains.
- Microspore mother cells form microspore by meiosis.

#### 3) Connective.

- It is a colum of sterile tissue.
- It is surrounded by anther lobe.
- It has vascular tissue.

## Part - III - ADDITIONAL QUESTIONS

### I. Match the following

1.	A	Camerarius	1	structure of flower	a)	A-1, B-2, C-4, D-3
	B	Hofmeister	2	Pollen Tetrad.	b)	A-1, B-2, C-3, D-4
	C	Hanning	3	Discovery of pollen tube	c)	A-4, B-3, C-2, D-1
	D	Amici	4	Embryo culture	d)	A-2, B-1, C-4, D-3

Ans :a) A-1, B-2, C-4, D-3

# Chromosomal Basis of Inheritance

## Part - I - TEXTBOOK EVALUATION

### 1. An allohexaploidy 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

Ans : c) Two copies of three different genomes

### 2. Match list I with list II

List I		List II	
A	A pair of chromosomes extra with diploid	i	monosomy
B	One chromosome extra to the diploid	ii	tetrasomy
C	One chromosome loses from diploid	iii	trisomy
D	Two individual chromosomes lose from diploid	iv	double monosomy

- a) A-i, B-iii, C-ii, D-iv  
c) A-ii, B-iii, C-i, D-iv

- b) A-ii, B-iii, C-iv, D-i  
d) A-iii, B-ii, C-i, D-iv

Ans : c) A-ii, B-iii, C-i, D-iv

### 3. Which of the following sentences are correct? **Qy ; Hy - 2019**

- The offspring exhibit only parental combinations due to incomplete linkage
  - The linked genes exhibit some crossing over in complete linkage
  - The separation of two linked genes are possible in incomplete linkage
  - Crossing over is absent in complete linkage
- a) 1 and 2                      b) 2 and 3  
c) 3 and 4                      d) 1 and 4

Ans : c) 3 and 4

### 4. 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

Ans : b) 7:1:1:7

### 5. The point mutation sequence for transition, transition, transversion and transversion in DNA are

- a) A to T, T to A, C to G and G to C  
b) A to G, C to T, C to G and T to A  
c) C to G, A to G, T to A and G to A  
d) G to C, A to T, T to A and C to G

Ans : b) A to G, C to T, C to G and T to A

### 6. If haploid number in a cell is 18. The double monosomic and trisomic number will be

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

Ans : a) 34 and 37

### 7. Changing the codon AGC to AGA represents

- a) missense mutation  
b) nonsense mutation  
c) frameshift mutation  
d) deletion mutation

Ans : a) missense mutation

### 8. 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 and R are correct  
b) A is correct. R is wrong  
c) A is wrong. R is correct  
d) A and R are wrong

Ans : b) A is correct. R is wrong

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9. When two different genes came from same parent they tend to remain together.

i) What is the name of this phenomenon?

ii) Draw the cross with suitable example.

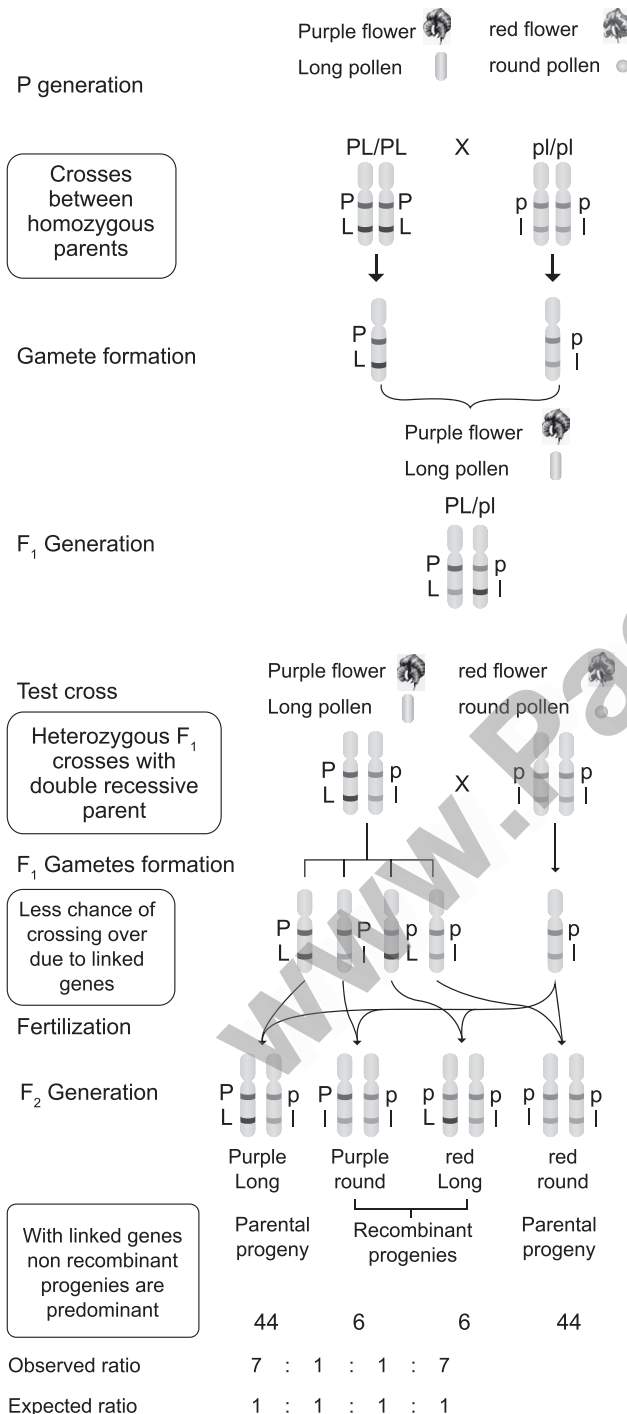
iii) Write the observed phenotypic ratio.

i) What is the name of this phenomenon?

Ans : Linkage

ii) Draw the cross with suitable example.

Alleles in coupling or cis configuration



iii) Write the observed phenotypic ratio.

Ans: 7 : 1 : 1 : 7

10. What is the difference between missense and nonsense mutation? **PTA-5 S.V. May 22**

	Missense mutation (Non synonymous)	Nonsense mutation (Termination)
1	The mutation where the codon for one amino acid is changed into a codon for another amino acid.	The mutations where codon for one amino acid is changed into a termination or stop codon.
2	Its another name is non - synonymous mutations	Its another name is termination mutation.
3	Change in amino acid encoded	Creates translational termination codon (UAA, UAG, UGA)

11.

A B C C B D E F G H I

From the above figure identify the type of mutation and explain it.

- It is a change in the arrangement of gene loci,
- Here the duplicated segment is located immediately after the normal segment but the gene sequence order will be reversed - (Paracentric inversion)

12. Write the salient features of Sutton and Boveri concept. **L.V. SEP-2020**

- Somatic cells of organisms are derived from the zygote by repeated cell division (mitosis).
- These consist of two identical sets of chromosomes. One set is received from female parent (maternal) and the other from male parent (Paternal)
- These two chromosomes constitute the homologous pair.

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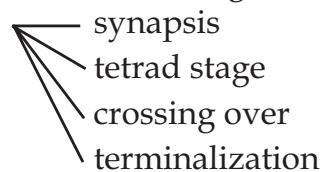
- Chromosomes retain their structural uniqueness and individuality throughout the life cycle of an organism.
- Each chromosome carries specific determiners of mendelian factors which are now termed as genes.
- The behaviour of chromosomes during the gamete formation (meiosis) provides evidence to the fact that genes or factors are located on chromosomes.

### 13. Explain the mechanism of crossing over.

**L.V. May 22 | L.V. Aug 22**

Crossing Over - it is a very significant biological process

It is a precise one with several stages



#### i) Synapsis :

**S.V. Aug 22**

During **zygotene** - of **prophase. I of meiosis I** the homologous chromosomes come and align side by side known as - **bivalents**.

This pairing - is known as **synapsis or syndesis**.

Types of synapsis

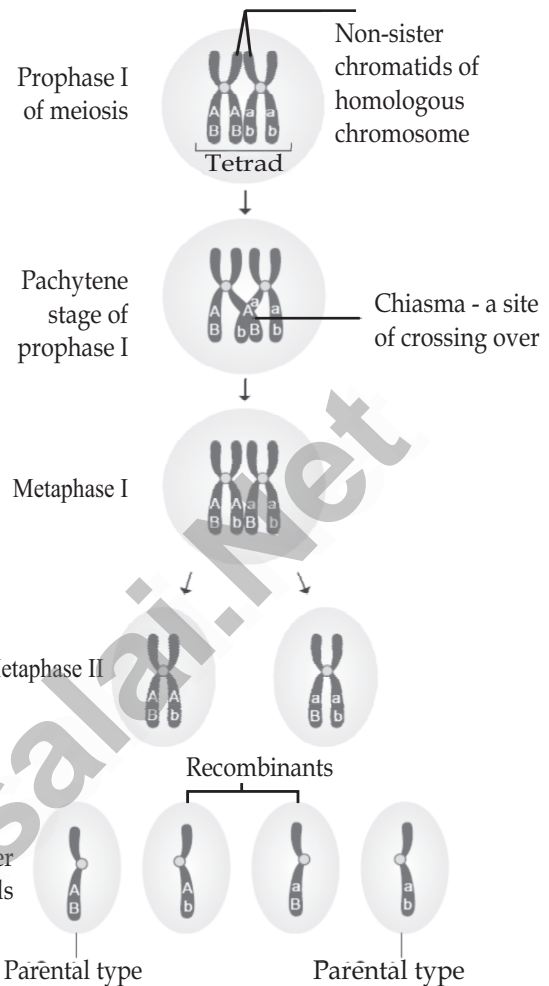
- **Procentric** - (pairing from middle)
- **proterminal** (pairing from telomeres)
- **Random** (pairing start from anywhere)

#### ii) Tetrad Formation :

Each homologous chromosome of - a bivalent begin to form two identical sister chromatids - held together by a centromere. Each bivalent has 4 chromatids - (**tetrad** stage).

#### iii) Cross Over :

At **pachytene** stage cross over occur. The points of contact at one or more points between non-sister chromatids is called **Chiasmata**.



**Mechanism of crossing over**

Crossing over is exchange of corresponding segments occur, in the chiasma region.

#### Synaptonemal Complex (SC)

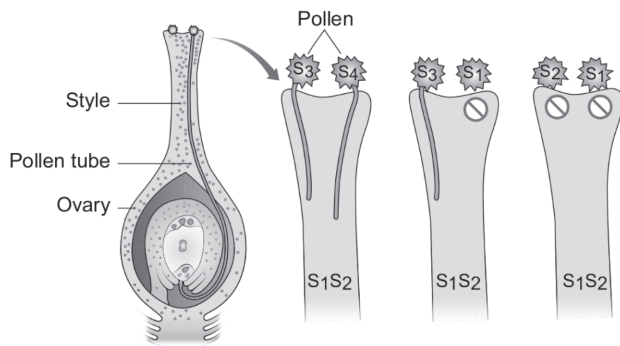
The highly organised structure of filaments called SC - facilitate chiasma formation.

**SC formation & chiasma formation - is absent in Drosophila**

#### Terminalisation :

After crossing over, chiasma starts to moving towards the terminal end of chromatids is known as **terminalisation**. Complete separation of homologous chromosomes occurs after terminalization.

14. How is *Nicotiana* exhibit self-incompatibility. Explain its mechanism.



**The self-incompatibility in relation to its genotype in tobacco**

- In *Nicotiana* self sterility or self incompatibility is due to multiple alleles.
- The pollen from a plant is unable to germinate on its own stigma - and no fertilization.
- The gene for self incompatibility can be - 'S' which has allelic series  $S_1, S_2, S_3, S_4$  &  $S_5$
- Cross-fertilizing tobacco - were not always homozygous as  $S_1S_1$  or  $S_2S_2$ , but heterozygous
- Crosses between different  $S_1S_2$  plants, pollen tube did not develop normally.
- **But effective - development observed when cross was made with other than  $S_1S_2$  Eg.  $S_3S_4$ .**

Female parent (Stigma spot)	Male parent (Pollen source)		
	$S_1S_2$	$S_2S_3$	$S_3S_4$
$S_1S_2$	Self Sterile	$S_3S_2$ $S_3S_1$	$S_3S_1$ $S_3S_2$ $S_4S_1$ $S_4S_2$
$S_2S_3$	$S_1S_2$ $S_1S_3$	Self Sterile	$S_4S_2$ $S_4S_3$
$S_3S_4$	$S_1S_3$ $S_1S_4$ $S_2S_3$ $S_2S_4$	$S_2S_3$ $S_2S_4$	Self Sterile

Different combinations of progeny in self-incompatibility

15. How sex is determined in monoecious plants. Write their genes involved in it.

**Zeamays** (maize) - monoecious plant Male & Female flowers are present on the same plant.

- **Terminal inflorescence** - arise from tassel bear staminate flowers
- **Lateral inflorescence** - arise from ear or cob bear pistillate flowers.
- **Unisexuality in maize** - occurs through selective abortion of ear florets and pistils in tassel florets.
- **The allele for barren plant (ba)**- when homozygous makes the stalk staminate (eliminating silk and ears)
- **The allele for tassel seed (ts)** - transforms tassel into a pistillate structure (no pollen produced)
- Most of these mutations are shown to be **defects in Gibberellins biosynthesis**.  
Gibberellins play an important role in the suppression of stamens in florets on the ears.

Geno type	Dominant recessive	Modification	Sex
$ba/ba$ $ts/ts$	Double recessive	Lacks silk on the stalk, but transformed tassel to pistil	Rudiment-ary female
$ba/ba$ $ts^+/ts^+$	Recessive and dominant	Lacks silk and have tassel	male
$ba^+/ba^+$ $ts^+/ts^+$	Double dominant	Have both tassel and cob	Monoecious
$ba^+/ba^+$ $ts/ts$	Dominant and recessive	Bears cob and locks tassel	Normal female

16. What is gene mapping? Write its uses.

S.V.GMQ-19 PTA 6

S.V. MAR-20, L.V. Aug -21

**Definition:**

Genes are present on the locus in a chromosome. They are arranged in a linear order.

The diagrammatic representation of position of genes and related distance between adjacent genes is called **Genetic mapping (linkage map)**.

- It is directly proportional to the frequency of recombination between them
- Concept of genetic mapping was 1st developed by **Morgan's student - Alfred H. Sturtevant (1913)**

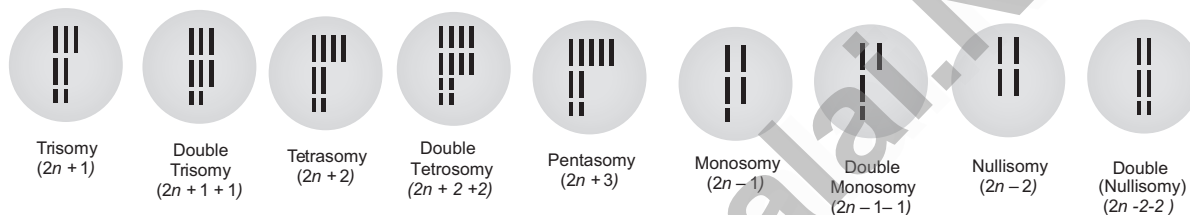
**Uses :**

- It is used to determine **gene order**, identify the **locus of a gene** and calculate the **distance between the genes**.
- They are useful in **predicting results of dihybrid and trihybrid crosses**.
- It helps to **understand the overall genetic complexity** of particular organism.

17. Draw the diagram of different types of aneuploidy.

L.V. GMQ -19

Types of aneuploidy



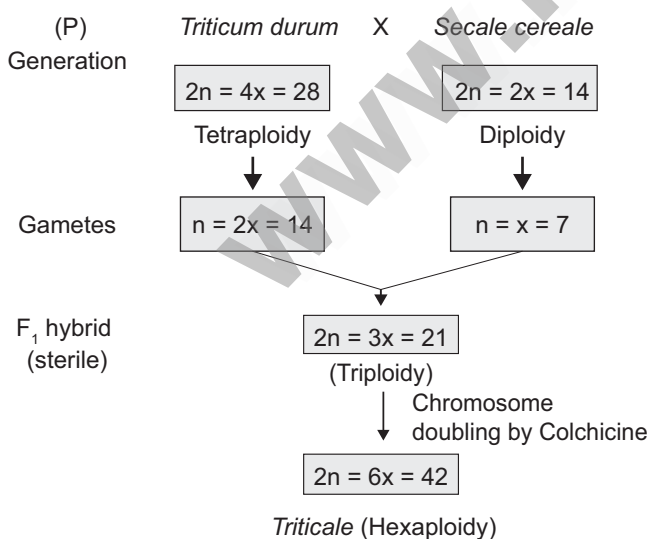
18. Mention the name of man - made cereal.  
How it is formed?

PTA - 1; S.V. Mar-20; Sep-20; Aug-21

Triticale is the successful first man made cereal.

Depending on the ploidy level

**Formation of triticale :**



Flow chart for Triticale

Triticale can be divided into three main groups :

- i) Tetraploidy :** Crosses between diploid wheat and rye.
- ii) Hexaploidy :** Crosses between tetraploid wheat *Triticum durum* (macaroni wheat) and rye
- iii) Octoploidy :**
  - Crosses between hexaploid wheat *T. aestivum* (bread wheat) and rye.
  - Hexaploidy Triticale hybrid plants demonstrate characteristics of both macaroni - wheat & rye
  - For example, they combine the high - protein content of wheat with rye's high content of the amino acid lysine, which is low in wheat.
  - Colchicine, an alkaloid applied in low concentration to the growing tips of the plants to induce polyploidy.

## Part - II - GMQ, PTA and Govt. Exam Question &amp; Answers

## I. Match the following

List I		List II	
(i)	Pentasomy	A	$2n - 2$
(ii)	Double monosomy	B	$2n + 1$
(iii)	Nullisomy	C	$2n - 1 - 1$
(iv)	Trisomy	D	$2n + 3$

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

PTA - 2

Ans : d) (i) D (ii) C (iii) A (iv) B

## II. Choose the Correct answer

1. In paddy haploid chromosome number is 12. If double monosomy happens, the chromosome number will be **L.V.GMQ-19**

- a) 10      b) 11      c) 12      d) 13

Ans: a) 10

2. How can we reverse the sterility of F<sub>1</sub> hybrid? **PTA - 3**

- a) Genetic Engineering  
 b) Protoplasmic fusion  
 c) Induced Mutation  
 d) Induced chromosomal aberration

Ans: d) Induced chromosomal aberration

3. If haploid number in a cell is 23. The double monosomic and pentasomy number will be **PTA - 5**

- a) 44 and 49      b) 17 and 34  
 c) 47 and 46      d) 45 and 48

Ans: a) 44 and 49

4. Genes located close together on the same chromosome and inherited together represented as **L.V. MAR-20**

- a) linked genes  
 b) unlinked gene  
 c) syntenic genes  
 d) trans genes

Ans: a) linked genes

## III. Assertion and Reason

1. Assertion (A) : Arabidopsis plant chromosomes have more repeats of TTT nucleotide sequences in the telomeres.

Reason (R) : Restriction endonuclease enzyme is used in the formation of nucleotide sequence (Telomeres)

a) (A) is incorrect, (R) is correct **L.V. MAR-20**

b) (A) is correct, (R) is the correct explanation (A)

c) (A) is correct, (R) is the incorrect explanation (A)

d) (A) and (R) are wrong.

Ans: b) (A) is correct, (R) is the correct explanation (A)

2. Assertion (A) : Increase in temperature increases the rate of mutation. **S.V. Sep -20**

Reason (R) : Rise in temperature breaks the hydrogen bonds between the nucleotides.

a) (A) is not correct, (R) is correct

b) (A) is correct, (R) is the not correct

c) (A) is correct, (R) is correct explanation of (A)

d) (A) and (R) are wrong.

Ans: c) (A) is correct, (R) is correct explanation of (A)

## IV. Find the correct statement

1. When red eyed female Drosophila is crossed with white eyed male, the F<sub>1</sub> offsprings would be **PTA - 3**

a) Females are with white eye and males are with red eye.

b) Males are with red eye and females are with yellow eye.

c) Both males and females are with red eye

d) Both males and females are with white eye.

Ans: c) Both males and females are with red eye



### V. Find the incorrect statement

1. Which one of the following is incorrect regarding chromosomal behaviour during cell division? **PTA - 4**

- The alleles of a genotype are found in the same locus of a homologous chromosome
- In the S phase of meiotic interphase each chromosome replicates forming two copies of each allele, one on each chromatid.
- The Homologous chromosomes segregate in metaphase I, thereby separating two different alleles.
- In anaphase II of meiosis separation of sister chromatid of homologous chromosomes takes place.

Ans: c) The Homologous chromosomes segregate in metaphase I, thereby separating two different alleles.

### VI. Two Mark Questions

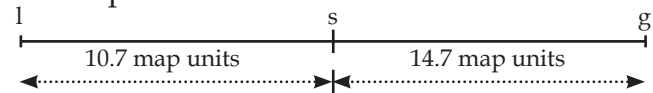
1. Differentiate tetrasomy from tetraploidy **PTA - 4**

	Tetrasomy	Tetraploidy
1	Addition of a pair or two individual chromosomes to diploid set is called Tetrasomy. (2n + 2)	Tetraploids have four copies of its own genome. They can be induced by doubling the chromosomes of a diploid species.
2	(2n + 2 + 2) This condition is known as double tetrasomy	There are two types Auto & Allotetraploidy
3	Eg: wheat	Eg: Grapes, ground nut, potato & coffee

2. How to construct a gene map? **PTA - 6**

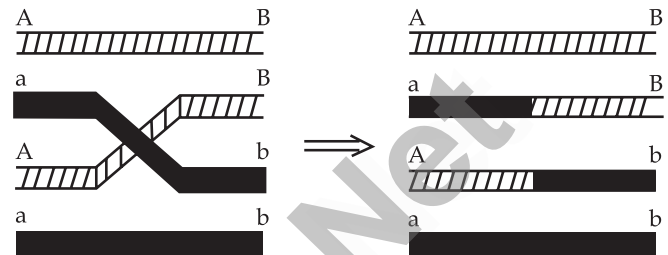
- All the loci are linked, because all the RF values are considerably less than 50%.
- In this L G loci show highest RF value, they must be farthest apart.
- Therefore, the S locus must lie between them.

➤ The order of genes should be l s g a genetic map can be drawn as follows.



3. a) Which type of crossing over is mentioned in the above diagram? **L.V. Mar - 20**

#### Single cross over



b) Mention the percentage of Recombination Frequency (RF)

$$RF = \frac{2}{4} \times 100 = 50\%$$

### VII. Three Mark Questions

1. Define multiple Alleles **S.V. GMQ-19**

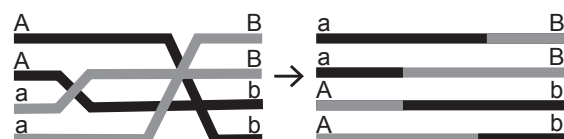
- When any of the three or more allelic forms of a gene occupy the same locus in a given pair of homologous chromosomes, they are said to be called multiple alleles.
- Eg : Self sterility in Nicotiana is controlled by multiple alleles.

2. List out the needs of capping **L.V. GMQ-19**  
**Purpose of capping**

- Protect RNA from degradation.
- Capping plays an important role in removal of first intron in pre mRNA.
- It regulates the mRNA export from the nucleus into the cytoplasm.
- It helps in binding of mRNA to the ribosome.

3. Draw the diagram showing four strand double cross over. **PTA - 3**

#### Four strand double cover



$$RF = \frac{4}{4} \times 100 = 100\%$$

## GOVT. SUPPLEMENTARY EXAM - AUGUST 2022

## BIO - BOTANY

[Time Allowed: 3.00 Hours]

[Maximum Marks : 35]

## Section - I

8 × 1 = 8

Note : 1) Answer **all** the Questions.

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

- Coleorhiza is found in \_\_\_\_\_  
**(a) Paddy** (b) Beans (c) Pea (d) Tridax
- In \_\_\_\_\_ the single gene affects multiple traits and alters the phenotype of the organism.  
 (a) Lethal genes (b) Epistatic **(c) Pleiotropy** (d) Hypostatic
- The bacteria responsible for inducing tumours in several dicot plants are \_\_\_\_\_  
 (a) Candida utilis (b) Spirulina  
 (c) Chlorella **(d) Agrobacterium tumifaciens**
- 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
- In soil, water available for plants is \_\_\_\_\_  
 (a) Gravitational water (b) Chemically bound water  
**(c) Capillary water** (d) Hygroscopic water
- 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**
- \_\_\_\_\_ 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
- 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 - II

4 × 2 = 8

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

- Give the types of synapsis.
- What is C-value?
- Differentiate Biotope and Ecotope.
- What is PAR ?
- What is SLF ?
- What is Bio-pest repellent ?

Chap- 3

Chap- 4

Chap- 6

Chap- 7

Chap- 9

Chap- 10

## Section - III

3 × 3 = 9

**Note :** Answer **any three** of the following questions. Question No. 19 is **compulsory**.

15. Draw and explain Hemianatropous Ovule with an example.

Chap- 1

16. Give the significance of ploidy.

Chap- 3

17. What is bio-remediation ? Give an example.

Chap- 4

18. Draw and explain the thermal stratification of a pond.

Chap- 6

19. What is Green house effect? What are the gases involved in it?

Chap- 8

## Section - IV

2 × 5 = 10

**Note :** Answer **all** the questions.

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

Chap- 1

OR

(b) Explain the incomplete dominance with example.

Chap- 2

21. (a) Explain the food web with an example. Give its significance.

Chap- 7

OR

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

Chap- 5



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EC - 12<sup>th</sup> Botany

## GOVT. SUPPLEMENTARY EXAM - AUGUST 2022

## BOTANY

[Time Allowed: 3.00 Hours]

[Maximum Marks : 70]

## PART - I

15 × 1 = 15

Note : 1) Answer **all** the Questions.2) Choose the **most appropriate** answer from the given **four** alternatives and write the option code and the corresponding answer.

- Which plant is called as the "King of bitter"?  
(a) Keezhanelli (b) Adathodai  
**(c) Nilavembu** (d) Neem
- Botanical name of Turmeric is:  
(a) Piper nigrum  
**(b) Curcuma longa**  
(c) Tamarindus indica  
(d) Capsicum annum
- Seaweed Liquid Fertilizer is made from:  
(a) Spirogyra (b) Chara  
**(c) Kelp** (d) Chlorella
- 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**
- The transfer of energy in an ecosystem between trophic levels can be termed as:  
(a) Food web **(b) Energy flow**  
(c) Consumers (d) Food chain
- Significance of food web is/are:  
(a) It does not maintain stability in nature  
(b) It shows patterns of energy transfer  
(c) It explains species interaction  
**(d) (b) and (c)**
- In soil, water available for plants is :  
(a) Gravitational water  
(b) Chemically bound water  
**(c) Capillary water**  
(d) Hygroscopic water
- In Haplopappus gracilis, number of chromosomes in cells of nucellus is 4. What will be the chromosome number in Primary endosperm cell ?  
(a) 8 (b) 12  
**(c) 6** (d) 2
- Coleorhiza is found in :  
**(a) Paddy** (b) Beans  
(c) Pea (d) Tridax
- 'The Father of Genetics' is \_\_\_\_\_  
**(a) Mendel** (b) W. Batesan  
(c) E. Bar (d) Carl Correns
- 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 \_\_\_\_\_  
(a) aaBB (b) AaBB  
(c) AABB **(d) aabb**
- A complex of ribosome attached to a single strand of RNA is known as:  
**(a) Polysome** (b) Polymer  
(c) Polypeptide (d) Okazaki fragment
- The algae used in the production of single cell protein :  
(a) Yeast  
(b) Agaricus campestris  
(c) Cellulomonas  
**(d) Chlorella**
- The appropriate temperature used for cryopreservation :  
(a) 196°C **(b) - 196°C**  
(c) 100°C (d) - 100°C
- The secondary metabolite Vincristine is:  
**(a) Anticarcinogenic** (b) Analgesic  
(c) Cardiac tonic (d) Antimalarial

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EC - 12<sup>th</sup> Botany**PART - II****6 × 2 = 12**

**Note:** Answer any six of the following.  
Question number 24 is compulsory.

16. Name the humors that are responsible for the health of human beings. **Chap-10**
17. What is carbon capture and storage? **Chap-8**
18. Productivity of profundal zone will be low. Why? **Chap-7**
19. Name the levels of ecological hierarchy. **Chap-6**
20. Define Explant. **Chap-5**
21. Write down the significance of parthenocarpy. **Chap-1**
22. What is replication fork? **Chap-3**
23. Name the chemicals used in gene transfer. **Chap-4**
24. What are lethal genes? **Chap-2**

**PART - III****6 × 3 = 18**

**Note:** Answer any six of the following.  
Question number 33 is compulsory.

25. Give the definition for Organic farming. **Chap-10**
26. What are plant indicators? Give example. **Chap-8**
27. Pyramid of energy is always upright. Give reasons. **Chap-7**
28. What is Phytoremediation? Give an example. **Chap-4**
29. Draw and label the structure of mature embryo sac. **Chap-1**
30. What is pleiotropy? Give an example. **Chap-2**

31. What is crossing over? In which stage it occurs in meiosis I? **Chap-3**
32. Write the advantages of Bt cotton. **Chap-4**
33. What is somaclonal variation? **Chap-5**

**PART - IV****5 × 5 = 25**

**Note:** Answer all the questions.

34. (a) Explain the preparation of Bio-pest repellent. **Chap-10**

**OR**

- (b) Explain the structure of an ovule with a suitable diagram. **Chap-1**
35. (a) What is hybridization? Explain the steps in hybridization. **Chap-9**

**OR**

- (b) Explain Mendel's Monohybrid cross with an example. **Chap-2**
36. (a) Write down the importance of Geographic Information System (GIS). **Chap-8**

**OR**

- (b) What attributes make Arabidopsis a suitable model plant for molecular genetic research? **Chap-3**
37. (a) Write down the differences between Primary succession and Secondary succession. **Chap-7**

**OR**

- (b) Explain the different interactions of plant with example. **Chap-2**
38. (a) Give an account on cryopreservation. **Chap-5**

**OR**

- (b) What is screening? Describe blue white colony selection method of screening. **Chap-4**

