SURA'S

ZOOLOGY

(Short version and Long version)

12th Standard

Based on the New Syllabus and
New Textbook for the year 2019-20

Salient Features

- Complete Solutions to Textbook Exercises.
- Exhaustive Additional Questions in all Units.
- NEET based Questions with Answers are also given.

SURA PUBLICATIONS
Chennai

orders@surabooks.com PH: 9600175757 / 8124201000 / 8124301000

2019-20 *Edition*

ISBN : 978-93-5330-076-0
Code No : SG 281

Authors
Dr. R. Srinivasan, M.Sc., M.Ed.,Ph.D., Chennai
Mrs. S. Amsaveni, M.Sc, Pudukottai

Edited by
Mrs. A. Jenifer, M.Sc., B.Ed., Nagercoil

Reviewed by
Dr. S. Shanti Priya M.Sc., M.Phil., Ph.D.
Head of the Department, Chennai

Head Office

Sura Publications
1620, 'J' Block, 16th Main Road,
Anna Nagar, **Chennai - 600 040.**
Phones : 044-26161088, 26161099.
Mobile : 96001 75757 / 81242 01000 / 81243 01000
Whatsapp : 81242 01000
e-mail : orders@surabooks.com
website : www.surabooks.com

For More Information - Contact

Doubts in Our Guides	:	enquiry@surabooks.com
For Order	:	orders@surabooks.com
Contact	:	96001 75757 / 8124301000
Whatsapp	:	8124201000 / 9840926027
Online Site	:	**www.surabooks.com**

For Free Study Materials Visit **http://tnkalvi.in**

Preface

'Each has his own tree of ancestors,
but at the top of all sits Probably Arboreal.'

- Robert Louis

Respected Principals, Correspondents, Head Masters / Head Mistresses, Teachers,

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

It is in our sincerest effort we take the pride of releasing **SURA'S Zoology** for +2 Standard – Edition 2019. This guide has been authored and edited by qualified teachers having teaching experience for over a decade in their respective subject fields. This Guide has been reviewed by reputed Professors who are currently serving as Head of the Department in esteemed Universities and Colleges.

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

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

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

God Bless all.

Subash Raj, B.E., M.S.
- Publisher
Sura Publications

All the Best

TO ORDER WITH US

SCHOOLS and TEACHERS:

We are grateful for your support and patronage to **'SURA PUBLICATIONS'**
Kindly prepare your order in your School letterhead and send it to us.
For Orders contact: 81242 01000 / 81243 01000

DIRECT DEPOSIT

A/c Name	: **Sura Publications**
Our A/c No.	: **36550290536**
Bank Name	: **STATE BANK OF INDIA**
Bank Branch	: PADI
IFSC	: SBIN0005083

A/c Name	: **Sura Publications**
Our A/c No.	: **21000210001240**
Bank Name	: **UCO BANK**
Bank Branch	: Anna Nagar West
IFSC	: UCBA0002100

A/c Name	: **Sura Publications**
Our A/c No.	: **6502699356**
Bank Name	: **INDIAN BANK**
Bank Branch	: ASIAD COLONY
IFSC	: IDIB000A098

A/c Name	: **Sura Publications**
Our A/c No.	: **1154135000017684**
Bank Name	: **KVB BANK**
Bank Branch	: Anna Nagar
IFSC	: KVBL0001154

After Deposit, please send challan and order to our address.
email : orders@surabooks.com / Whatsapp : 81242 01000.

DEMAND DRAFT / CHEQUE

Please send Demand Draft / cheque in favour of **'SURA PUBLICATIONS'** payable at **Chennai**.

The Demand Draft / cheque should be sent with your order in School letterhead.

STUDENTS :

Order via Money Order (M/O) to

SURA PUBLICATIONS
1620, 'J' Block, 16th Main Road, Anna Nagar, Chennai - 600 040.
Phones : 044-26162173, 26161099.
Mobile : 96001 75757/ 81242 01000/81243 01000.
Email : orders@surabooks.com
Website : www.surabooks.com

CONTENTS

ZOOLOGY LONG VERSION

(FOR PURE SCIENCE GROUP)

UNIT I

Chapter 1

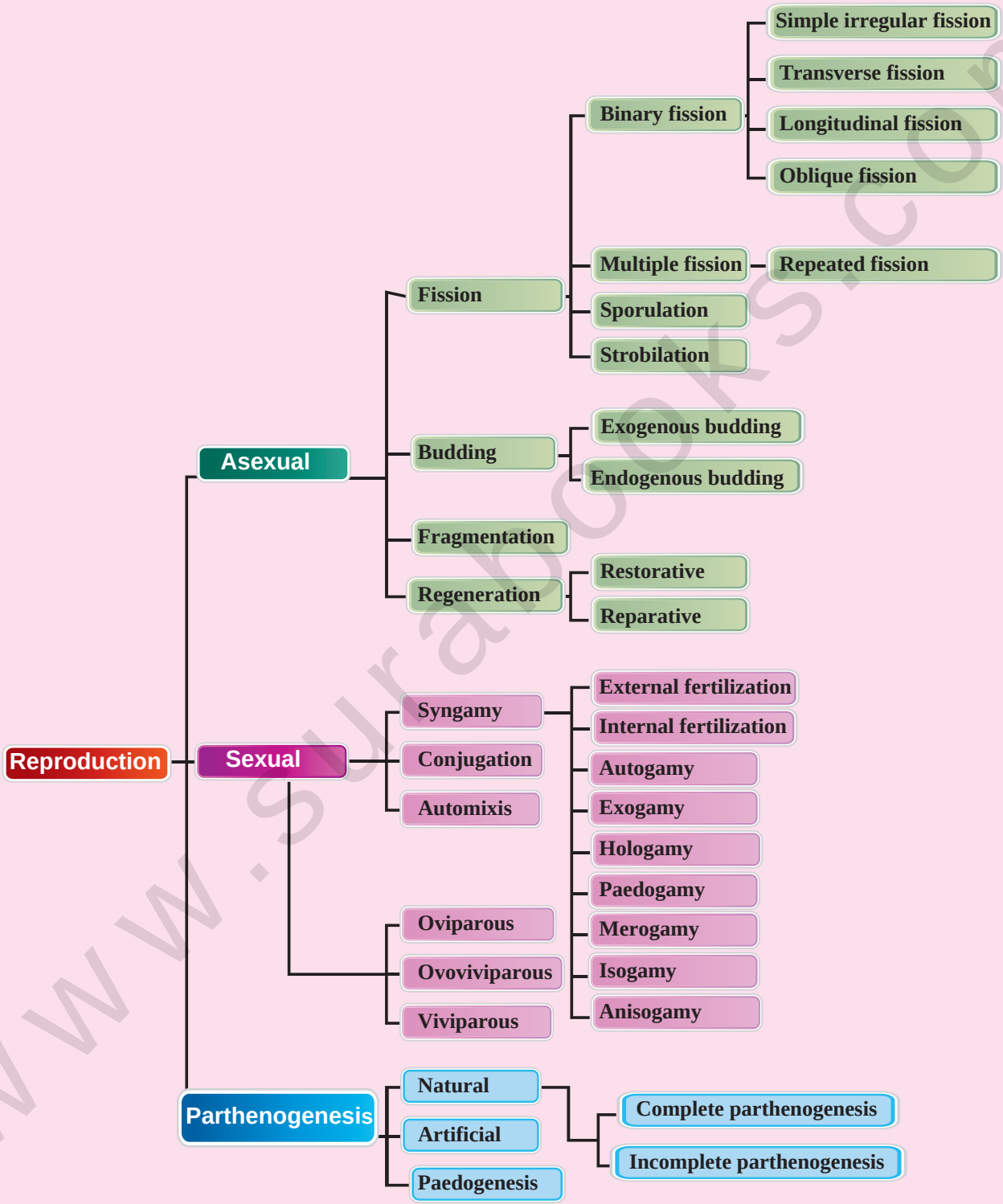
REPRODUCTION IN ORGANISMS

CHAPTER SNAPSHOT

MUST KNOW DEFINITIONS

Asexual reproduction	:	Reproduction by single parent involving amitotic or mitotic divisions only.
Sexual reproduction	:	Participation of two individuals and involves formation of male and female gamete.
Fission	:	Division of parent body into two or more identical Daughter individuals.
Binary fission	:	Parent organism divides into two daughter cells.
Multiple fission	:	Parent body divides into many similar daughter cells.
Strobilation	:	A special type of transverse fission giving rise to number of individuals.
Budding	:	Parent body produces one or more buds which separate from the parent and lead an independent life
Gemmule	:	Internal buds formed is sponge which can tolerate adverse conditions and are a means of asexual reproduction.
Apolysis	:	Separation of gravid proglottids from the body of a tape worm.
Regeneration	:	Regrowth in the injured region.
External fertilization	:	Fusion of male & female gametes takes place outside the body of the female organism.
Internal fertilization	:	Fusion of male and female gametes takes place within the body of the female organism.
Fertilization	:	Fusion of male & female gametes.
Conjugation	:	Type of sexual reproduction between two individuals, where certain amount of nuclear material exchange takes place after which they separate.
Parthenogenesis	:	Development of an egg into a complete individual without fertilization.
Oviparous condition	:	Young ones hatch from eggs laid outside the mother's body.
Viviparous condition	:	Animals give birth to young ones.
Ovoviviparous conditions	:	Embryo develops inside the eggs and remains in the mother's body until they are ready to hatch.

Concept Map



Evaluation

1. In which type of parthenogenesis are only males produced?

(a) Arrhenotoky (b) Thelytoky
(c) Amphitoky (d) Both a and b

[Ans. (a) Arrhenotoky]

2. Animals giving birth to young ones:

(a) Oviparous (b) Ovivivipara
(c) Viviparous (d) Both a and b

[Ans. (c) Viviparous]

3. The mode of asexual reproduction in bacteria is by

(a) Formation of gametes
(b) Endospore formation
(c) Conjugation
(d) Zoospore formation

[Ans. (b) Endospore formation]

4. In which mode of reproduction variations are seen

(a) Asexual (b) Parthenogenesis
(c) Sexual (d) Both a and b

[Ans. (c) Sexual]

5. 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) 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. (C) If A is true but R is false]

III. **Assertion:** Viviparous animals give better protection to their offsprings.
Reason: They lay their eggs in the safe places of the environment.
A B C D

[Ans. (C) A is true but R is false]

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

Ans. Bacteria, *Amoeba.*

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

Ans. Phenomenon – Parthenogenesis
Eg: Turkey.

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

Ans. ***(i)*** Development of an egg into a complete individual without fertilization is known as parthenogenesis.
(ii) Parthenogenesis is of two main types namely, **Natural Parthenogenesis** and **Artificial Parthenogenesis**.
(iii) Ex: Honey bees, Gall fly.

9. Which type of reproduction is effective -Asexual or sexual and why?

Ans. ***(i)*** Reproduction is a biological process by which organisms produce their young ones. Reproduction results in continuation of species and introduces variations in organisms which are essential for adaptation and evolution of their own kind.
(ii) Sexual Reproduction can only bring about variation in the organism since it involves fusion of gametes from two different individuals, (parents). A sexual reproduction involves uniparental inheritance and cannot bring about variation.
(iii) Thus, sexual & asexual reproduction can help to create the next generation but only sexual reproduction is said to be more effective than asexual reproduction

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

Ans. **(i)** In **binary fission** (asexual reproduction), the parental organism divides into two halves and each half forms a daughter individual. This is seen in unicellular organism like bacteria, *Amoeba* etc.

(ii) At maturity the single parent cell divides, to form the daughter cells. The parent cell does not die but it becomes a part of the daughter cells formed.

(iii) Thus the unicellular organisms which reproduce by binary fission are considered immortal.

(iv) In other cases of asexual reproduction, the parent produces special structures like buds, spores etc for reproduction but the parent organism continues to live and grow. It dies a natural death.

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

Ans. Clones refers to the group of genetically identical cells or organisms asexually produced from a single progenitor cell or organism Asexual reproduction involves a single parent. Offsprings produced by asexual reproduction are morphologically and genetically similar to their parents and are hence called clones.

12. Why are the offsprings of oviparous animal at a greater risk as compared to offsprings of viviparous organisms?

Ans. Oviparous animals lay eggs outside their body. These eggs are exposed to various environmental conditions and may be eaten by predators also. They face lot of risks until the young ones hatche. But the offsprings of viviparous animals are more safe and protected in the maternal womb until they are born.

13. Give reasons for the following:

(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.

Ans. **(a)** Development of an egg into a complete individual without fertilization is known as parthenogenesis It is of two types. Natural parthenogenesis occurs in Nature in many animals such as honey bees. Artificially it can be induced in animals by physical or chemical stimuli which is called artificial parthenogenesis.

(b) In honey bees both sexual reproduction and parthenogenesis occurs, and it is described as incomplete parthenogenesis. It is a kind of natural parthenogenesis.

During sexual reproduction, the fertilized eggs (zygotes) develop into queen bee and workers (females). The unfertilized eggs develop into drones (males). This honey bees are called parthenogenesis animals.

In honey bees the normal chromosomal number in a cell is $2n = 32$. Gametes (sperms & egg) will have only $n = 16$ chromosomes since they are haploid. The female bees are formed by fertilization of gametes.

$$\text{sperm } (n) + \text{egg } (n) = 2n$$

Therefore they have 32 chromosomes. Since the drones (males) are formed from unfertilized eggs(n) they have only 16 chromosomes. Honey bees show incomplete parthenogenesis.

14. Differentiate between the following:

(a) Binary fission in *amoeba* and multiple fission in *Plasmodium*

(b) Budding in yeast and budding in *Hydra*

(c) Regeneration in lizard and *Planaria*

Ans.

(a)

Binary Fission in *Amoeba*	Multiple fission in *Plasmodium*
The nucleus divides mitotically only once.	The nucleus divides repeatedly
The cell constricts in the middle after nuclear division to form the daughter cells.	The cytoplasm divides into as many parts as that of nuclei and each part encircles a daughter nucleus.
Two daughter cells are formed.	Many daughter cells are formed.

(b)

Budding in Yeast	Budding in *Hydra*
Yeast is a unicellular organism. The single cell produces an outgrowth to form a bud. Nucleus of the parent cell divides and a daughter nuclei enters the bud which is unicellular.	The Bud is developed by mitotic divisions of its cells and is multicellular.
A Chain of buds may be formed in the parent cell at times.	Chain of buds are not formed.

In both cases, the buds separate and lead an independent life

(c) Regeneration is regrowth in the injured region

Regeneration in *Planaria*	Regeneration in lizard
It shows the morphallaxis type of regeneration in which the whole body grows from a small fragment	Lizard shows the epimorphosis type of regeneration in which replacement of lost body parts occur.
The whole body can be got by regeneration	It shows the restorative type of regeneration in which several body parts can only develop but the whole body cannot develop.

15. How is juvenile phase different from reproductive phase?

Ans. Organisms have three phases – Juvenile phase, reproductive phase and senescent phase.

(i) Juvenile phase/ vegetative phase is the period of growth between the birth of the individual upto reproductive maturity.

(ii) During reproductive phase/ maturity phase the organisms reproduce and their offsprings reach maturity period.

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

16. What is the difference between syngamy and fertilization?

Ans. The entire process involved in fusion of male and female gamete in sexual reproduction is called fertilization. It includes the entry of sperm into the egg followed by fusion of nuclei to form a zygote. Syngamy refers to the process of fusion of the male & female gametes. (fusion of cytoplasm and nuclei)

Additional Questions

Choose the Correct Answer — 1 Mark

I. Choose the Correct options for the below Questions

1. Transverse Binary fission is seen is ____

(a) *Vorticella* (b) *Paramecium*
(c) Plasmodium (d) Euglena

[Ans. (b) *Paramecium*]

2. In dinoflagellates the types of asexual reproduction seen is _____

(a) Simple Binary fission
(b) Multiple fission
(c) Oblique binary fission
(d) Longitudinal binary fission

[Ans. (c) Oblique binary fission]

3. Multiple fission is seen in _____

(a) *Vorticella* and ceratium
(b) Plasmodium and *paramecium*
(c) *Amoeba* and cyanobacteria
(d) *Vorticella* and plasmodium

[Ans. (d) *Vorticella* and plasmodium]

4. During favourable conditions _____ shows multiple fission.

(a) Plasmodium
(b) *Amoeba*
(c) Planaria
(d) Euglena

[Ans. (b) *Amoeba*]

5. Plasmotomy is observed in _____
(a) Giant Amoeba (b) *Hydra*
(c) Plasmodium (d) Ceratium
[Ans. (a) Giant Amoeba]

6. Giant Amoeba refers to _____
(a) Opalina (b) Pelomyxa
(c) Ceratium (d) Trichonympha
[Ans. (b) Pelomyxa]

7. _____ is seen in *Aurelia.*
(a) Binary fission (b) Regeneration
(c) Sporulation (d) Strobilation
[Ans. (d) Strobilation]

8. Budding is seen in _____
(a) Noctiluca (b) *Amoeba*
(c) Nostoc (d) *Planaria*
[Ans. (a) Noctiluca]

9. Gemmules are _____
(a) Exogenous growth
(b) Daughter nuclei
(c) Internal buds
(d) Regenerated parts
[Ans. (c) Internal buds]

10. Regeneration is not seen in _____
(a) Starfish (b) Lizard
(c) *Hydra* (d) Sea Anemone
[Ans. (d) Sea Anemone]

11. Autogamy is seen in _____
(a) *Paramecium* (b) Plasmodium
(c) *Hydra* (d) *Amoeba*
[Ans. (a) *Paramecium*]

12. If the entire organism behaves as a gamete, the Phenomenon is called ____
(a) Autogamy (b) Syngamy
(c) Morphallaxis (d) Hologamy
[Ans. (d) Hologamy]

13. Conjugation is a type of _____
(a) Asexual reproduction
(b) Autogamy
(c) External fertilization
(d) Sexual reproduction
[Ans. (d) Sexual reproduction]

14. Conjugation is seen in _____
(a) *Vorticella* (b) *Amoeba*
(c) Reptiles (d) Actinosphaerium
[Ans. (a) *Vorticella*]

15. Paedogamy is the sexual union of ____
(a) morphologically different gametes
(b) physiologically different gametes
(c) young individuals immediately after the formation from parents
(d) dissimilar gametes
[Ans. (c) young individuals immediately after the formation from parent cell]

16. _____ is a seasonal breeder
(a) Poultry (b) Honey bees
(c) Deers (d) Rabbit
[Ans. (c) Deers]

17. Technique used for cultivation of sponges is based on _____
(a) Multiple fission (b) Parthenogenesis
(c) Regeneration (d) Autogamy
[Ans. (c) Regeneration]

18. External fertilization is seen is _____
(a) Mammals and birds
(b) Reptiles and sponges
(c) Fishes and birds
(d) Sponges and amphibians
[Ans. (d) Sponges and amphibians]

19. Isogamy is observed in _____
(a) Monocystis (b) Mammals
(c) *Trichonympha* (d) Reptiles
[Ans. (a) Monocystis]

20. Human beings exhibit _____
(a) Hologamy (b) Exogamy
(c) Isogamy (d) Paedogammy
[Ans. (b) Exogamy]

21. Paedogenesis is seen in _____
(a) Gall fly (b) Honey bees
(c) Aphis (d) *Hydra*
[Ans. (a) Gall fly]

22. Ovovivipary is seen in _____
(a) Solenobia (b) Humans
(c) Birds (d) Shark
[Ans. (d) Shark]

23. **Which statement is incorrect regarding the type of binary fission?**
(a) Transverse binary fission in seen in *Planaria*.
(b) Longitudinal binary fission in seen in *Euglena*.
(c) Oblique binary fission in seen in *flagellates* .
(d) Simple binary fission in seen in *Amoeba*.
[Ans. (c) Oblique by fission in seen in flagellates]

24. **All of the following are methods of asexual reproduction except.**
(a) Regeneration (b) Conjugation
(c) Sporulation (d) Fragmentation
[Ans. (d) Conjugation]

25. **This is a method of sexual reproduction in which individuals of the same species temporarily write and exchange certain amount of nuclear material and then get separated.**
(a) Syngamy (b) Conjugation
(c) Parthenogenesis (d) Paedogenesis
[Ans. (b) Conjugation]

26. **All the following animals are continuous breeders, except.**
(a) Frogs (b) Honey bees
(c) Poultry (d) Rabbit
[Ans. (a) Frogs]

27. **In honey bees, the mode of reproduction is**
(a) Sexual and Asexual
(b) Sexual and Parthenogenesis
(c) Asexual and Parthenogenesis
(d) All the above
[Ans. (b) Sexual and Parthenogenesis]

28. **In honey bees, the unfertilized egg produces.**
(a) Queen bee (b) Worker bee
(c) Drones
(d) Worker bee and male honey bee
[Ans. (c) Drones]

29. **This is the sexual union of young individuals produced immediately after the division of the adult parent cell by mitosis.**
(a) Paedogamy (b) Hologamy
(c) Merogamy (d) Anisogamy
[Ans. (a) Paedogamy]

II. Choose the Correct Options for the Below Fill in the Blanks

1. ***Paramecium* and *planaria* show _____ types of division during asexual reproduction**
(a) Transverse binary fission
(b) Longitudinal binary fission
(c) Simple binary fission
(d) Oblique binary fission
[Ans. (a) Transverse binary fission]

2. **Special type of transverse division seen in *Aurelia* is called _____.**
(a) plasmotomy (b) strobilation
(c) pedal laceration (d) sporulation
[Ans. (b) strobilation]

3. **Fragmentation in sea Anemone is also known as _____.**
(a) morphallaxis (b) pedal laceration
(c) archaeocytes (d) epimorphosis
[Ans. (b) pedal laceration]

4. **Endogenous buds are seen in _____.**
(a) *Trichonympha* (b) *Hydra*
(c) Actinosphaerium (d) Noctiluca
[Ans. (d) Noctiluca]

5. **The gravid proglottids are cut off from the parent body in _____**
(a) Tapeworm (*Taenia solium*)
(b) Liver fluke
(c) *Planaria* (d) Blood fluke
[Ans. (a) Tapeworm (*Taenia solium*)]

6. **Regeneration was first studied by _____**
(a) A.G. Tansley (b) Charles Bonnet
(c) Abraham Trembley (d) Walter Gilbert
[Ans. (c) Abraham Trembley]

7. **Regeneration was first studied in _____**
(a) star fish (b) *Planaria*
(c) *Hydra* (d) *Aurelia*
[Ans. (c) *Hydra*]

8. **Starfish shown ____ type of regeneration.**
(a) epimorphosis - reparative
(b) epimorphosis (restorative)
(c) morphallaxis
(d) paedogenesis
[Ans. (b) epimorphosis (restorative)]

9. The sexual union of young individuals produced immediately after the division of the parent cell is called _____.
(a) Paedogamy (b) hologamy
(c) merogamy (d) isogamy
[*Ans.* (a) Paedogamy]

10. _____ refers to the fusion of small sized, morphologically different gametes
(a) Isogamy (b) Hologamy
(c) Paedogamy (d) Merogamy
[*Ans.* (d) Merogamy]

11. Fusion of morphologically and physiologically similar gametes is called _____.
(a) anisogamy (b) hologamy
(c) isogamy (d) merogamy
[*Ans.* (c) isogamy]

12. Exchange of certain amount of nuclear material during sexual reproduction is called _____.
(a) strobilation (b) conjugation
(c) pedal laceration (d) sporulation
[*Ans.* (b) conjugation]

13. Paedogenetic parthenogenesis is seen in ____
(a) planula larvae of enidarians
(b) Cydippid larvae of pleurobranchia
(c) Redia larvae of liver fluke
(d) Trochophore larvae of Annelids.
[*Ans.* (c) Redia larvae of liver fluke]

14. In _____ types of natural parthenogenesis only females are produced.
(a) Thelytoky (b) Arrhenotoky
(c) paedogenesis (d) Amphitoky
[*Ans.* (a) Thelytoky]

15. In _____ types of parthenogenesis egg can develop into individuals of any sex.
(a) Thelytoky (b) paedogenesis
(c) Amphitoky (d) Arrhenotoky
[*Ans.* (c) Amphitoky]

16. _____ is a process by which the proglottids are cut off from the tapeworm.
(a) Apolysis (b) pedal laceration
(c) budding (d) plasmotomy
[*Ans.* (a) Apolysis]

III. Identify the correct Statements

1. (i) Budding is seen in *leucosolenia*
(ii) In *paramecium* multiple fission occurs
(iii) In autogamy, the male and female gametes are produced by the same cell.
(iv) Internal fertilization occurs in frogs
(a) i and iii (b) i and iv
(c) ii and iii (d) ii and iv
[*Ans.* (a) i and iii]

2. (i) Lizard is a continuous breeder.
(ii) Asexual reproduction is also known as somatogenic reproduction
(iii) In repeated fission, young ones do not separate till fission process is completed.
(iv) strobilation is a kind of longitudinal fission.
(a) i and iii (b) i, ii and iv
(c) ii and iii (d) ii and iv
[*Ans.* (c) ii and iii]

IV. Match the following

1.

1.	Strobilation	(a)	*Hydra*
2.	Regeneration	(b)	*Noctiluca*
3.	Conjugation	(c)	Bacteria
4.	Endogenous budding	(d)	*Aurelia*

A) 1 – b 2 – c 3 – a 4 – d
B) 1 – d 2 – a 3 – c 4 – b
C) 1 – d 2 – a 3 – b 4 – c
D) 1 – a 2 – d 3 – c 4 – b
[*Ans.* (B) 1 – d 2 – a 3 – c 4 – b]

2.

1.	Archaeocytes	(a)	Gall fly
2.	Buds	(b)	Gemmules
3.	Pseudopodiospores	(c)	*Hydra*
4.	Parthenogenesis	(d)	*Amoeba*

(A) 1 – d 2 – b 3 – a 4 – c
(B) 1 – d 2 – c 3 – a 4 – b
(C) 1 – c 2 – b 3 – d 4 – a
(D) 1 – b 2 – c 3 – d 4 – a
[*Ans.* (D) 1 – b 2 – c 3 – d 4 – a]

V. Identify the correct assertion and reason

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.

1. **Assertion :** In paramecium, the macronucleus divides by amitosis and the micronucleus divides by mitosis.
Reason : Paramecium shows transverse binary fission

[Ans. (A) Both A and R are true and R is correct explanation for A]

2. **Assertion :** Ovoviviparity is seen is shark
Reason : Placenta is formed to transfer nutrients to the embryo

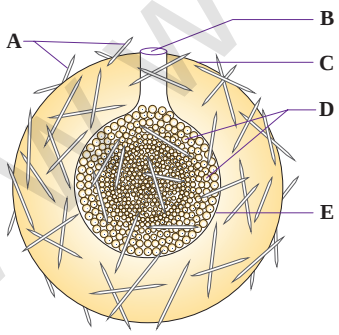
[Ans. (C) A is true but R is false]

3. **Assertion :** The embryos of ovoviviparous animals have no placental connection with their mothers.
Reason : Embryos receive nourishment from the egg yolk.

[Ans. (A) Both A and R are true and R is correct explanation for A]

VI. Identify the correct options for the parts of the diagram

1.



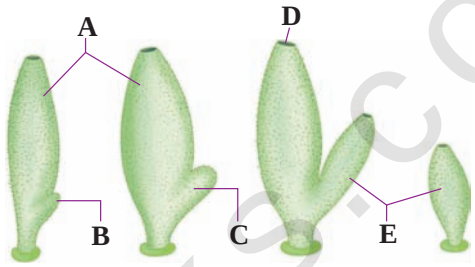
Identify the correct option to label the diagram

1 – Archaeocytes 2 – Inner membrane
3 – Micropyle
4 – Outer membrane
5 – Monaxon spicules

(a) 1-A 2-D 3-B 4-C 5- E
(b) 1-C 2-B 3-A 4-E 5-D
(c) 1-D 2-E 3-B 4-C 5-A
(d) 1-A 2-E 3-D 4-B 5-C

[Ans. (c) 1-D 2-E 3-B 4-C 5-A]

2.



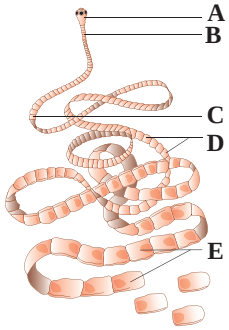
Identify the correct option to label the diagram

1 – Bud forming 2 – Osculum
3 – Bud growing 4 – Daughter individual
5 – Individual parent

(a) 1-A 2-D 3-B 4-C 5- E
(b) 1-B 2-D 3-C 4-E 5-A
(c) 1-D 2-E 3-B 4-C 5-A
(d) 1-A 2-E 3-D 4-B 5-C

[Ans. (b) 1-B 2-D 3-C 4-E 5-A]

3.



Identify the correct option to label the diagram
Identify the structure

1 – Immature proglottids
2 – Gravid proglottids
3 – Scolex
4 – Mature proglottids
5 – Neck

(a) 1-C 2-E 3-A 4-D 5- B
(b) 1-B 2-D 3-C 4-E 5-A
(c) 1-D 2-E 3-B 4-C 5-A
(d) 1-A 2-E 3-D 4-B 5-C

[Ans. (a) 1-C 2-E 3-A 4-D 5- B]

VII. Identify the Correct pair from the below

1. i. Shark - placenta
   ii. *Taenia solium* - Regeneration
   iii. Frog - Continuous breeder
   iv. Plasmotomy - *Pelomyxa*
   (a) i and iii (b) ii and iii
   (c) i and iv (d) i, ii and iv
   [Ans. (c) i and iv]

2. i. Sporogony - *Paramecium*
   ii. Bacteria - Uniparental inheritance
   iii. *Amoeba* - Multiple fission
   iv. Birds - External fertilization
   (a) i, ii and iv (b) iii and iv
   (c) ii and iv (d) ii and iii
   [Ans. (c) ii and iii]

VIII. Identify the Incorrect pair from the below

1. i. Starfish - Gemmule
   ii. Exogamy - *Amoeba*
   iii. Tapeworm - Pig
   iv. Continuous breeder - Poultry
   (a) i, ii and iii (b) ii, iii and iv
   (c) i and iv (d) i and ii
   [Ans. (d) i and ii]

2. i. *Planaria* - Morphallaxis
   ii. Conjugation - *Amoeba*
   iii. Autogamy - *Paramecium*
   iv. Apolysis - sea anemones
   (a) i and iii (b) ii and iv
   (c) ii and iii (d) i, iii and iv
   [Ans. (b) ii and iv]

3. i. *Hologamy* - Fusion of nature individuals
   ii. Merogamy - Fusion of small sized, morphologically different gametes.
   iii. Paedogamy - Fusion of young individuals
   iv. Isogamy - Fusion of dissimilar gametes.
   (a) i and iii (b) ii and iv
   (c) ii and iii (d) iv
   [Ans. (d) iv]

IX. Identify the Odd-man out from the below

1. (a) *Amoeba* (b) *Paramecium*
   (c) *Vorticella* (d) *Hydra*
   [Ans. (d) Hydra]
   Reason: It reproduces, asexually by budding whereas the others reproduce asexually by fission.

2. (a) *Hydra* (b) *Noctiluca*
   (c) Sea anemones (d) *Leucosolenia*
   [Ans. (c) sea anemones]
   Reason: It reproduces asexually by fragmentation whereas the others reproduce a sexually by Budding.

3. (a) Conjugation (b) Hologamy
   (c) Paedogamy (d) Regeneration
   [Ans. (d) Regeneration]
   Reason: It is associated with asexual reproduction whereas the others are associated with sexual reproduction.

4. (a) Honey bees (b) Shark
   (c) Human being (d) Cow
   [Ans. (c) Honey bees]
   Reason: It shows sexual reproduction and parthenogenesis in its life cycle, whereas the others show sexual reproduction only

Answer in one word*

1. Ovoviviparity is seen in ____ **[Ans. shark]**
2. _____ serves to transfer nutrients to the young ones of viviparous animals before birth. **[Ans. placenta]**
3. The eggs are covered by a membrane in ____ **[Ans. Amphibians]**
4. Replacement of lost body parts is called _____ **[Ans. epimorphosis]**
5. Exogenous buds are seen in ____. **[Ans. *Hydra*]**
6. Division of cytoplasm is called _____ **[Ans. cytokinesis]**
7. Division of nucleus is called _____. **[Ans. karyokinesis]**

* Only for quick revision not in pattern

8. Repeated fission is seen in _____.
[Ans. *vorticella*]

9. Oblique binary fission is seen in _____.
[Ans. *ceratium*]

10. Longitudinal binary fission is seen in _____
[Ans. *vorticella*]

11. The multiple fission of the schizont in plasmodium is called _____
[Ans. schizogony]

12. Schizogony leads to the production of _____ in plasmodium. [Ans. Merozoites]

13. Multiple fission of the oocyte in plasmodium is called _____.
[Ans. sporogony]

14. During multiple fission *Amoebae* produce _____.
[Ans. Amoebulae or Pseudopodiospores]

15. The temporary union of two individuals of same species is called ____.
[Ans. conjugation]

Very Short Answers — 2 Marks

1. Name the types of fission.

Ans. Binary fission, multiple fission, sporulation, and strobilation.

2. What is peculiar about the cell division of paramecium?

Ans. In paramecium, the macronucleus divides by amitosis and the micronucleus divides by mitosis.

3. What is plasmotomy?

Ans. *(i)* Plasmotomy is the division of multinucleated parent into many multinucleate daughter individuals with the division of nuclei.

(ii) Nuclear division occurs later to maintain normal number of nuclei.

(iii) Plasmotomy occurs in *Opalina* and *Pelomyxa.*

(iv) It is a method of asexual reproduction.

4. What are exogenous buds?

Ans. When buds are formed on the outer surface of the parent body, it is known as **exogenous budding. E.g.** *Hydra.*

5. Define regeneration mention the types.

Ans. *(i)* Regeneration is regrowth in the injured region.

(ii) Regeneration is of two types, (a) morphallaxis (b) epimorphosis.

6. What is morphallaxis?

Ans. It is a type of regeneration. In **morphallaxis**, the whole body grows from a small fragment. **E.g.** *Hydra.*

7. What is epimorphosis?

Ans. *(i)* It is type of regeneration which involves replacement of the lost body pants. It is of two types.

(ii) Reparative regeneration, only certain damaged tissue can be regenerated.

(iii) Restorative regeneration – several body parts can develop. **E.g.** Star fish.

8. What is syngamy?

Ans. In **syngamy**, the fusion of two haploid gametes takes place to produce a diploid zygote.

9. What is autogamy?

Ans. It is a type of fertilization. In **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.*

10. What is exogamy?

Ans. It is a type of fertilization. In exogamy, the male and female gametes are produced by different parents and they fuse to form a zygote. So it is biparental. **E.g.** Human – dioecious or unisexual animal.

11. Define hologamy.

Ans. It is a type of fertilization. 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.*

12. What is merogamy?

Ans. It is a type of fertilization in **merogamy**, the fusion of small sized and morphologically different gametes (merogametes) takes place.

13. Define isogamy.

Ans. The fusion of morphological and physiological identical gametes (isogametes) is called **isogamy**. **E.g.** *Monocystis.*

14. Define conjugation.

Ans. **Conjugation** is the 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. **E.g.** *Paramecium*

15. How are animals classified based on breeding periods?

Ans. ***(i)*** On the basis of time, breeding animals are of two types: seasonal breeders and continuous breeders.

(ii) Seasonal breeders reproduce at particular period of the year such as frogs, lizards, most birds, deers etc., Continuous breeders continue to breed throughout their sexual maturity. **E.g.** honey bees, poultry, rabbit etc.

16. Mention the phases in the life cycle of an organism.

Ans. Juvenile phase / Vegetative phase, reproductive phase/ maturity phase, Senescent phase.

17. What is paedogenesis?

Ans. ***(i)*** In paedogenetic parthenogenesis (paedogenesis) the larvae produce a new generation of larvae by parthenogenesis.

(ii) It occurs in the sporocysts and Redia larvae of liver fluke.

18. What is artificial parthenogenesis?

Ans. In artificial parthenogenesis, the unfertilized egg (ovum) is induced to develop into a complete individual by physical or chemical stimuli. **E.g.** Annelid and seaurchin eggs.

19. Name the types of natural parthenogenesis.

Ans. ***(i)*** Arrhenotoky – e.g. honey bees

(ii) Thelytoky – e.g. Solenobia

(iii) Amphitoky – e.g. *Aphis*.

20. With regard to asexual reproduction, mention two phenomena seen is *Hydra*.

Ans. Budding and Regeneration.

21. Mention the types of asexual reproduction seen in *amoeba*.

Ans. ***(i)*** Binary fission

(ii) Encystment and spore formation – unfavourable conditions

(iii) Sporulation - unfavourable conditions

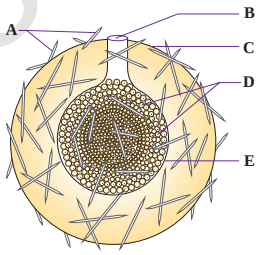
22. During which stages does multiple fission occur is plasmodium.

Ans. In plasmodium multiple fission occurs in the schizont and oocyte stages.

23. Mention the different modes of asexual reproduction.

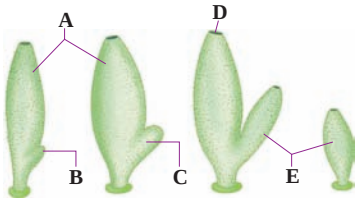
Ans. The different modes of asexual reproduction seen in animals are fission, sporulation, budding, gemmule formation, fragmentation and regeneration.

24. Identify the parts marked as A, B, C, D and E for the below diagram.



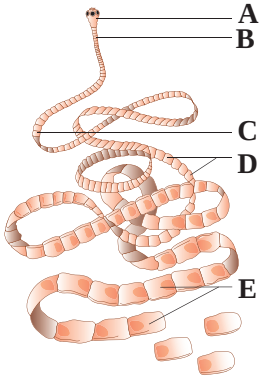
Ans. A – Monaxon spicules
B – Micropyle
C – Outer membrane
D – Archaeocytes
E – Inner membrane

25. Identify the parts marked as A, B, C, D and E for the below diagram.



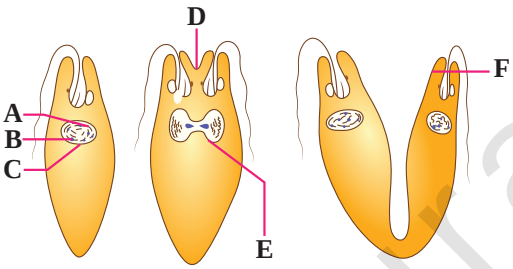
Ans. A – Individual parent
B – Bud forming
C – Bud growing
D – Osculum
D – Daughter individual

26. Identify the parts marked as A, B, C, D and E for the below diagram.



Ans. A – Scolex
B – Neck
C – Immature proglottids
D – Mature proglottids
E – Gravid proglottids

27. Identify the parts marked as A, B, C, D, E and F for the below diagram.



Ans. A - Chromosomes
B – Nucleoli
C – Nucleus
D – Longitudinal furrow
E – Nuclear constriction
F – Daughter Euglena

Short Answers — 3 Marks

1. What is asexual reproduction?

Ans. *(i)* Reproduction by a single parent without the involvement of gamete formation is asexual reproduction and the offspring produced are genetically identical. (uniparental inheritance)

(ii) Asexual reproduction is usually by amitotic or mitotic division of the somatic (body) cells, hence is also known as somatogenic or blastogenic reproduction. **Eg.** members of Protista, Bacteria.

2. What is repeated fission?

Ans. If multiple fission produces four or many daughter individuals by equal cell division and the young ones do not separate until the process is complete, then this division is called repeated fission. **E.g.** *Vorticella*.

3. Explain multiple fission in plasmodium.

Ans. *(i)* In Plasmodium, multiple fission occurs in the schizont and in the oocyte stages. When multiple fission occurs in the schizont, the process is called schizogony and the daughter individuals are called merozoites.

(ii) When multiple fission occurs in the oocyte, it is called sporogony and the daughter individuals are called sporozoites.

4. Explain encystment in *amoeba*.

Ans. *(i)* During unfavorable conditions *Amoeba* withdraws its pseudopodia and secretes a three-layered, protective, chitinous cyst wall around it and becomes inactive. This phenomenon is called encystment.

(ii) When conditions become favourable, the encysted *Amoeba* divides by multiple fission and produces many minute amoebae called pseudopodiospore or amoebulae.

(iii) The cyst wall breaks off liberating the young pseudopodiospores.

5. What is strobilation?

Ans. *(i)* In some metazoan animals, a special type of transverse fission called strobilation occurs.

(ii) In the process of strobilation, several transverse fissions occur simultaneously giving rise to a number of individuals which often do not separate immediately from each other. **E.g.** *Aurelia*.

6. Differentiate exogenous and endogenous budding.

Ans.

Exogenous budding	Endogenous Budding
Buds are formed on the outer surface of the parent body.	Buds are formed inside the cytoplasm within the body of the parent
E.g. Hydra	**E.g.** Noctiluca

7. What is apolysis? Write its significance.

Ans. *(i)* In Tape worm the gravid proglottids are regularly cut off either singly or in groups from the posterior end by a process called apolysis.

(ii) This is very significant since it helps in transferring the developed embryos from the primary host (man) to find a secondary host (pig).

8. Explain the types of fertilization depending on the place of occurrence.

Ans. Depending upon the place where the fertilization takes place, it is of two types.

(i) **External fertilization:** 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.

(ii) **Internal fertilization:** In internal fertilization, the fusion of male and female gametes takes place within the body of female organisms. **E.g.** reptiles, aves and mammals.

9. Differentiate autogamy and exogamy.

Ans.

Autogamy	Exogamy
It is a type of fertilization in which male and female gametes are produced by the same cell or same organism and both gametes fuse together to form a zygote.	It is a type of fertilization in which the male and female gametes produced by different parents fuse to form a zygote.
Only one parent is involved **E.g.** paramecium	It is biparental **E.g.** human being

10. Why is conjugation considered to be a form of reproduction though there is no formation of a new individual?

Ans. *(i)* **Conjugation** is the temporary union of the two individuals of the same species. During which they exchange certain amount of nuclear material (DNA) and then get separated. **E.g.** bacteria.

(ii) No new individual is formed but after conjugation the two conjugants (participating organisms) show changes in their nuclear content. When they reproduce by asexual method, their off springs will inherit the nuclear content with changes. Hence **conjugation** is considered to a form of reproduction.

11. What are gemmules?

Ans. *(i)* It is a mode of asexual reproduction in sponges.

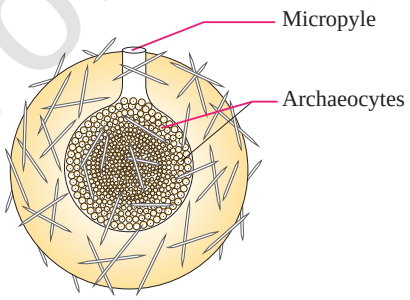
(ii) Internal buds called **gemmules** are formed which is a hard ball, consisting of an internal mass of food laden archaeocytes.

(iii) During unfavourable conditions, the sponge disintegrates, but the gemmule withstands adverse conditions.

(iv) The gemmules hatch during favourable conditions.

12. Draw a gemmule and label any 2 parts.

Ans.



13. Differentiate oviparous and viviparous condition.

Ans.

Oviparous condition	Viviparous condition
The young ones hatch from eggs laid outside the mother's body	The animals give birth to young ones.
The eggs are covered by hard calcareous shells in land animals.	The eggs lack a calcareous shell
The embryo is nourished by egg yolk.	The embryo is nourished in the uterus of the parent through the placenta.
Parental care is less **E.g.** Reptiles	Parental care is for a longer period **E.g.** mammals

14. What is ovoviviparous condition?

Ans. **(i)** In **Ovoviviparous** animals, the embryo develops inside the egg and remains in the mother's body until they are ready to hatch.

(ii) This method of reproduction is similar to Viviparity but the embryos have no placental connection with the mother and receive their nourishment from the egg yolk. Ovoviviparity is seen in fishes like shark.

15. How does budding occurs is *hydra*?

Ans. **(i)** Buds are formed on the outer surface of the parent body, it is known as **exogenous budding** e.g. *Hydra*.

(ii) In *Hydra* when food is plenty, the ectoderm cells increase and form a small elevation on the body surface.

(iii) Ectoderm and endoderm are pushed out to form the bud. The bud contains an interior lumen in continuation with parent's gastrovascular cavity.

(iv) The bud enlarges, develops a mouth and a circle of tentacles at its free end.

(v) When fully grown, the bud constricts at the base and finally separates from the parent body and leads an independent life.

16. Describe pedal laceration.

Ans. **(i)** In **fragmentation**, the parent body breaks into fragments (pieces) and each of the fragment has the potential to develop into a new individual.

(ii) Fragmentation or **pedal laceration** occurs in many genera of sea anemones.

(iii) Lobes are constricted off from the pedal disc and each of the lobe grows mesenteries and tentacles to form a new sea anemone.

17. Describe the different phases of life cycle in an organism.

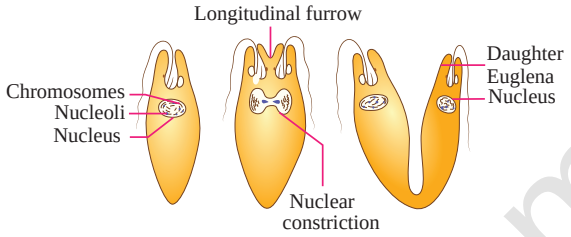
Ans. Organisms have three phases in its life cycle.

(i) **Juvenile phase/ vegetative phase** is the period of growth between the birth of the individual upto reproductive maturity.

(ii) **Reproductive phase/ maturity phase** the organisms reproduce and their offsprings reach maturity period.

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

18.



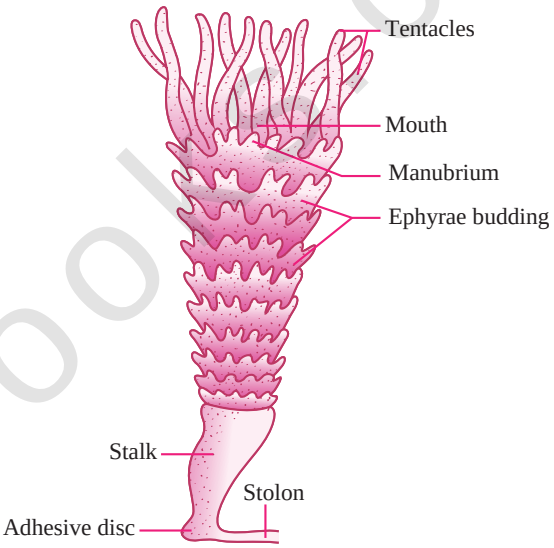
(i) Identify the Process.

(ii) Name the Organism.

Ans. **(i)** Longitudinal binary fission

(ii) *Euglena*

19.



(i) Identify the animal.

(ii) What is significant about the animal.

Ans. **(i)** *Aurelia*

(ii) The significance is that *Aurelia* reproduces asexually by a special type of transverse fission called strobilation.

Long Answers — 5 Marks

1. Write a note on regeneration.

Ans. **(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.

(iv) The parts usually retain their original polarity, with oral ends, by developing tentacles and aboral ends, by producing basal discs.

(v) **Epimorphosis** is the replacement of lost body parts. It is of two types, namely **reparative** and **restorative** regeneration.

(vi) In reparative regeneration, only certain damaged tissue can be regenerated, whereas in restorative regeneration several body parts can develop. **E.g.** star fish, tail of wall lizard.

2. Explain parthenogenesis.

Ans. *(i)* Development of an egg into a complete individual without fertilization is known as parthenogenesis.

(ii) It was first discovered by Charles Bonnet in 1745. Parthenogenesis is of two main types namely, natural Parthenogenesis and artificial Parthenogenesis.

(iii) In certain animals, parthenogenesis occurs regularly, constantly and naturally in their life cycle and is known as natural parthenogenesis.

Natural parthenogenesis are of different types:

a) **Arrhenotoky :** In this type only males are produced by parthenogenesis. **E.g:** honey bees

b) **Thelytoky :** In this type of parthenogenesis only females are produced by parthenogenesis. **E.g:** Solenobia

c) **Amphitoky :** In this type parthenogenetic egg may develop into individuals of any sex. **E.g:** *Aphis*.

(iv) Natural parthenogenesis may be of two types, viz., complete and incomplete. **Complete parthenogenesis** is the only form of reproduction in certain animals and there is no biparental sexual reproduction. These are no male organisms and so, such individuals are represented by females only.

(v) **Incomplete parthenogenesis** is found in some animals in which both sexual reproduction and parthenogenesis occurs. **E.g.** In honeybees; fertilized eggs (zygotes) develop into queen and workers, whereas unfertilized eggs develop into drones (male).

(vi) In **paedogenetic parthenogenesis (paedogenesis)** the larvae produce a new generation of larvae by parthenogenesis.

(vii) It occurs in the sporocysts and Redia larvae of liver fluke. It is also seen in the larvae of some insects. **E.g.** Gall fly.

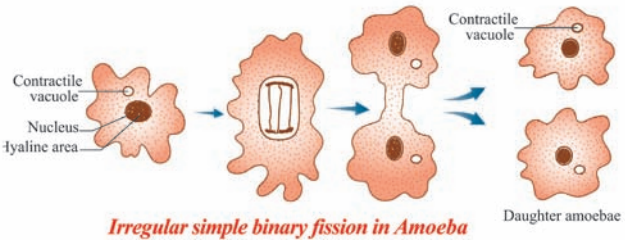
(viii) In **artificial parthenogenesis,** the unfertilized egg (ovum) is induced to develop into a complete individual by physical or chemical stimuli. **E.g.** Annelid and seaurchin eggs.

3. Write notes on binary fission in animals.

Ans. In **binary fission**, the parent organism divides into two halves and each half forms a daughter individual. The nucleus divides first amitotically or mitotically (**karyokinesis**), followed by the division of the cytoplasm (**cytokinesis**). The resultant offsprings are genetically identical to the parent. Depending on the plane of fission, binary fission is of the following types

(i) Simple irregular binary fission
(ii) Transverse binary fission
(iii) Longitudinal binary fission
(iv) Oblique binary fission

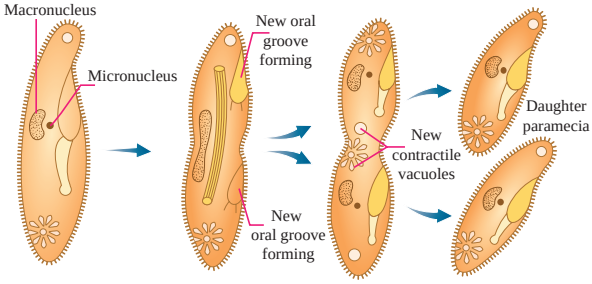
(i) **Simple binary fission** is seen in *Amoeba* like irregular shaped organisms, where the plane of division is hard to observe. The contractile vacuoles cease to function and disappear. The nucleoli disintegrate and the nucleus divides mitotically. The cell then constricts in the middle, so the cytoplasm divides and forms two daughter cells.



Irregular simple binary fission in Amoeba

(ii) In **transverse binary fission**, the plane of the division runs along the transverse axis of the individual. **E.g.** *Paramecium*

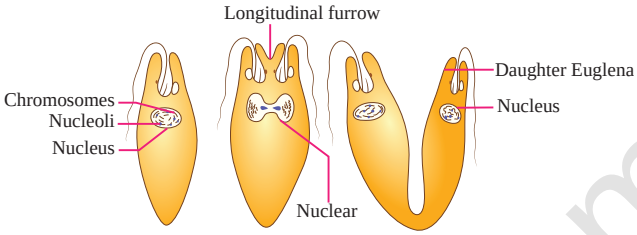
and *Planaria*. In *Paramecium* the macronucleus divides by amitosis and the micronucleus divides by mitosis.



Transverse binary fission in Paramecium

(iii) In **longitudinal binary fission**, the nucleus and the cytoplasm divides in the longitudinal axis of the organism. In flagellates, the flagellum is retained usually by one daughter cell. The basal granule is divided into two and the new basal granule forms a flagellum in the other daughter individual. **E.g.** *Vorticella* and *Euglena*.

(iv) In **oblique binary fission** the plane of division is oblique. It is seen in dinoflagellates. **E.g.** *Ceratium*.



Longitudinal binary fission in Euglena

HOTS

1. The organisms exhibiting sexual reproduction shows variations. Give reasons.

Ans. ***(i)*** Sexual reproduction involves formation of gametes by meioses brings in exchange of chromosomal segments between paternal and maternal chromosomes.

(ii) Fertilization is a chance of probability because the ovum is can be fertilized by any of the sperms. Hence variations will occur and degree of variations cannot be predicted in sexual reproduction.

Unit Test

[Time : 1 hr] [Marks: 25]

I. Choose the Correct Answer. 10 × 1 = 10

1. **Technique used for cultivation of sponges is based on _____**
(a) Multiple fission (b) Parthenogenesis
(c) Regeneration (d) Autogamy

2. **Conjugation is a type of _____**
(a) Asexual reproduction
(b) Autogamy
(c) External fertilization
(d) Sexual reproduction

3. **Choose the correct pair**
i. **Shark - placenta**
ii. ***Taenia solium* - Regeneration**
iii. **Frog - Continuous breeder**
iv. **Plasmotomy - *Pelomyxa***
(a) i and iii (b) ii and iii
(c) i and iv (d) i, ii and iv

4. (i) **Lizard is a continuous breeder.**
(ii) **Asexual reproduction is also known as somatogenic reproduction**
(iii) **In repeated fission, young ones do not separate till fission process is completed.**
(iv) **strobilation is a kind of longitudinal fission.**
(a) i and iii (b) i, ii and iv
(c) ii and iii (d) ii and iv

5. **Starfish shown ____ type of regeneration.**
(a) epimorphosis - reparative
(b) epimorphosis (restorative)
(c) morphallaxis
(d) paedogenesis

6. **Assertion : Ovoviviparity is seen is shark**
Reason : Placentas is formed to transfer nutrients to the embryo
(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.

7. **Which statement is incorrect regarding the type of binary fission stated?**
(a) Transverse binary fission in seen in *Planaria*.
(b) Longitudinal binary fission in seen in *Euglena*.
(c) Oblique binary fission in seen in *flagellates*.
(d) Simple binary fission in seen in *Amoeba*.

8. **Division of cytoplasm is called _____**
(a) karyokinesis (b) cytokinesis
(c) *Trichonympha* (d) Paedogamy

9. **The mode of asexual reproduction in bacteria is by**
(a) Formation of gametes
(b) Endospore formation
(c) Conjugation
(d) Zoospore formation

10. **In which mode of reproduction variations are seen**
(a) Asexual (b) Parthenogenesis
(c) Sexual (d) Both a and b

II. Very Short Answer 2 × 2 = 4

11. What is repeated fission? Give an example.
12. Explain apolysis.

III. Short Answer 2 × 3 = 6

13. What is
(a) Merogamy (b) Hologamy
14. Draw a gemmula and label any two parts.

IV. Long Answer 1 × 5 = 5

15. Write a note on parthenogenesis.

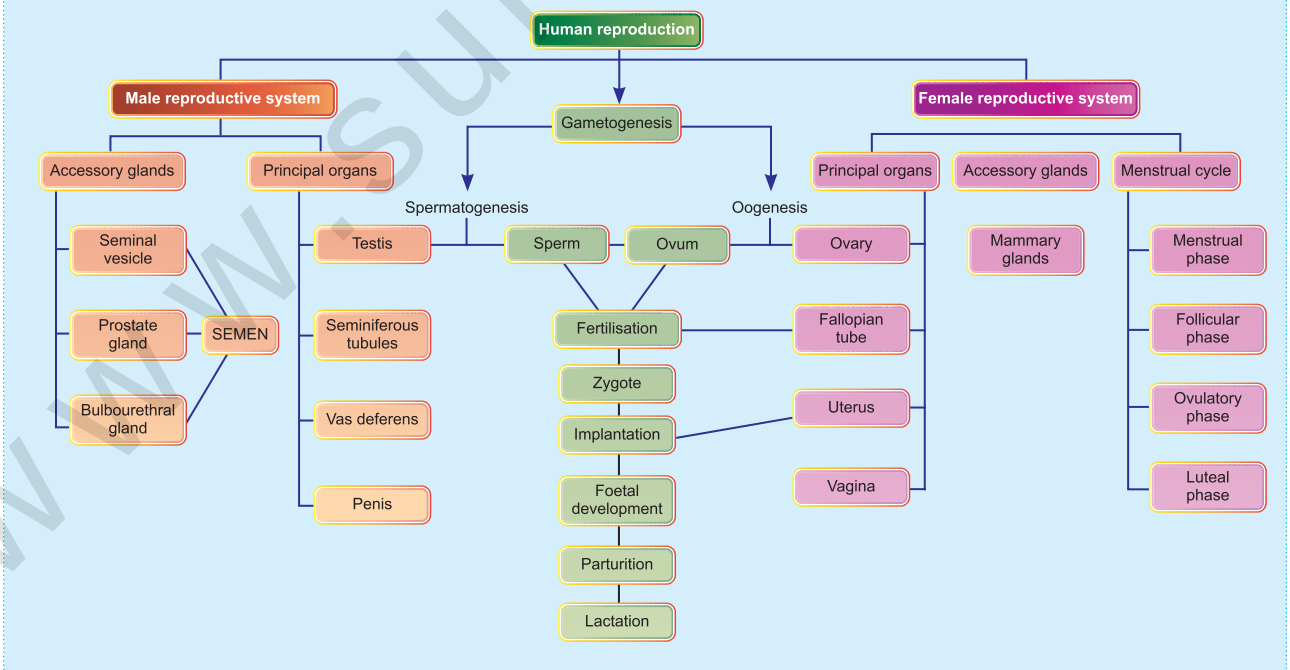
UNIT I

Chapter 2

HUMAN REPRODUCTION

CHAPTER SNAPSHOT

Concept Map



MUST KNOW DEFINITIONS

Gametogenesis	:	Formation of gametes by spermatogenesis and oogenesis.
Insemination	:	Transfer of sperms by the male into the female genital tract.
Fertilisation	:	Fusion of male and female gametes to form zygote is called fertilisation.
Cleavage	:	Rapid mitotic divisions of the zygote which convert the single celled zygote into a multicellular structure called blastocyst.
Implantation	:	Attachment of blastocyst to the uterine wall.
Placentation	:	Formation of placenta which is the intimate connection between foetus and uterine wall of the mother for exchange of nutrients.
Gastrulation	:	Process by which blastocyst is changed into a gastrula with three primary germ layers
Organogenesis	:	Formation of specific tissues, organs and organ systems from three germ layers.
Parturition	:	Expulsion of the foetus from the mother's womb.
Sertoli cells	:	Elongated and pyramidal cells which provide nourishment to sperms till maturation.
Semen	:	Milky white fluid which contains sperms & seminal plasma
Fallopian tube	:	Oviduct or uterine tube which receives the egg after ovulation
Uterus	:	Hollow, thick – walled, inverted pear shaped structure in female reproductive system in which implantation of embryo occurs.
Mammary glands	:	Modified sweat glands involved in lactation in females and rudimentary in males.
Spermatogenesis	:	Process of formation of sperms in seminiferous tubules of testis
Oogenesis	:	Process of development of ovum in the ovaries
Spermiogenesis	:	The spermatids are transformed into mature sperms by the process of spermiogenesis.
FSH	:	Follicle stimulating hormone produced by the pituitary gland
LH	:	Lutenizing Hormone produced by the pituitary gland
ABP	:	Androgen Binding protein
Acrosome	:	Pointed structure at the tip of the sperm head.
Hyaluronidase	:	Proteolytic enzyme produced by acrosome of sperm,
Menstrual cycle	:	Ovarian cycle occurring once in every 28/29 days during reproductive life of female from menarche to menopause except during pregrancy.
Graafian follicle	:	Mature ovarian follicle which releases the egg.
Corpus luteum	:	Temporary endocrine gland formed from ruptured graffian follicle during pregnancy.
Placenta	:	Disc shaped temporary endocrine organ formed during pregnancy which connects foetus and uterine wall.
Gastrulation	:	The transformation of the blastocyst into a gastrula with the primary germ layers by the movement of the blastomeres is called gastrulation.
Gestation	:	Period for which the foetus is in the mother's womb.
hCS	:	Human Chorionic Somatomammotropin
hCG	:	Human Chorionic Gonadotropin
hPL	:	Human Placental Lactogen
Polyspermy	:	Entry of more than one sperm into the ovum.

Evaluation

1. **The mature sperms are stored in the**
(a) Seminiferous tubules (b) Vas deferens
(c) Epididymis (d) Seminal vesicle
[Ans. (c) Epididymis]

2. **The male sex hormone testosterone is secreted from**
(a) Sertoli cells (b) Leydig cell
(c) Epididymis (d) Prostate gland
[Ans. (b) Leydig cell]

3. **The glandular accessory organ which produces the largest proportion of semen is**
(a) Seminal vesicle
(b) Bulbourethral gland
(c) Prostate gland
(d) Mucous gland **[Ans. (a) Seminal vesicle]**

4. **The male homologue of the female clitoris is**
(a) Scrotum (b) Penis
(c) Urethra (d) Testis
[Ans. (b) Penis]

5. **The site of embryo implantation is the**
(a) Uterus (b) Peritoneal cavity
(c) Vagina (d) Fallopian tube
[Ans. (a) Uterus]

6. **The foetal membrane that forms the basis of the umbilical cord is**
(a) Allantois (b) Amnion
(c) Chorion (d) Yolk sac
[Ans. (a) Allantois]

7. **The most important hormone in intiating and maintaining lactation after birth is**
(a) Oestrogen (b) FSH
(c) Prolactin (d) Oxytocin
[Ans. (c) Prolactin]

8. **Mammalian egg is**
(a) Mesolecithal and non cleidoic
(b) Microlecithal and non cleidoic
(c) Alecithal and non cleidoic
(d) Alecithal and cleidoic
[Ans. (c) Alecithal and non cleidoic]

9. **The process which the sperm undergoes before penetrating the ovum is**
(a) Spermiation (b) Cortical reaction
(c) Spermiogenesis (d) Capacitation
[Ans. (d) Capacitation]

10. **The milk secreted by the mammary glands soon after child birth is called**
(a) Mucous (b) Colostrum
(c) Lactose (d) Sucrose
[Ans. (b) Colostrum]

11. **Colostrum is rich in**
(a) Ig E (b) Ig A
(c) Ig D (d) Ig M
[Ans. (b) Ig A]

12. **The Androgen Binding Protein (ABP) is produced by**
(a) Leydig cells (b) Hypothalamus
(c) Sertoli cells (d) Pituitary gland
[Ans. (c) Sertoli cells]

13. **Which one of the following menstrual irregularities is correctly matched?**
(a) Menorrhagia - excessive menstruation
(b) Amenorrhoea - absence of menstruation
(c) Dysmenorrhoea - irregularity of menstruation
(d) Oligomenorrhoea - painful menstruation
[Ans. (b) Amenorrhoea - absence of menstruation]

14. **Find the wrongly matched pair**
(a) Bleeding phase - fall in oestrogen and progesterone
(b) Follicular phase - rise in oestrogen
(c) Luteal phase - rise in FSH level
(d) Ovulatory phase - LH surge
[Ans. (c) Luteal phase - rise in FSH level]

Answer the following type of questions
Assertion (A) and Reason (R)

(a) A and R are true, R is the correct explanation of A
(b) A and R are true, R is not the correct explanation of A
(c) A is true, R is false
(d) Both A and R are false

15. A – In human male, testes are extra abdominal and lie in scrotal sacs.
R – Scrotum acts as thermoregulator and keeps temperature lower by 2°C for normal sperm production .
[*Ans.* (a) A and R are true, R is the correct explanation of A]

16. A – Ovulation is the release of ovum from the Graafian follicle.
R – It occurs during the follicular phase of the menstrual cycle.
[*Ans.* (c) A is true, R is false]

17. A – Head of the sperm consists of acrosome and mitochondria.
R – Acrosome contains spiral rows of mitochondria.
[*Ans.* (d) Both A and R are false]

18. Mention the differences between spermiogenesis and spermatogenesis.

Ans.

Spermiogenesis	Spermatogenesis
Spermiogenesis is a part of spermatogenesis in which the haploid spermatids formed from secondary spermatocytes are transformed into mature spermatozoa.	Spermatogenesis is the sequence of all the events involved in the formation of male gametes or the sperms in the seminiferous tubule of the testis.
It is a stage in the maturation phase of spermatogenesis.	It includes multiplication, growth and maturation phase.

19. **At what stage of development are the gametes formed in new born male and female?**

Ans. *(i)* In a new born male, spematogenesis (formation of sperms) starts at the age of puberty. It is initiated due to the increase in the release of Gonadotrop in Releasing hormone.

(ii) Oogenesis is the process of development of the female gamete or egg in the ovaries. During foetal development, certain cells in the germinal epithelium of foetal ovary divide by mitosis and produce millions of oogonia or egg mother cells.

(iii) No more oogonia are added after birth. The oogonial cells enter into prophase I of meiosis to form primary oocytes which are temporarily arrested at this stage.

(iv) The primary oocytes then become primary follicles. From birth to puberty, a large number of follicles degenerate. At puberty the primary follicle undergoes further development and finally releases the ovum.

20. **Expand the acronyms**
a. FSH b. LH c. hCG d. hPL

Ans. (a) FSH – Follicular Stimulating Hormone
(b) LH – Leutinising Hormone
(c) hCG – Human Chorionic Gonadotropin
(d) hPL – Human Placental Lactogen.

21. **How is polyspermy avoided in humans?**

Ans. *(i)* During the process of fertilization in humans, the acrosome of the sperm enters through the corona radiata and zona pellucida layers of the ovum by releasing a enzyme called hyaluronidase. which is called acrosomal reaction.

(ii) Once fertilization is accomplished, cortical granules from the cytoplasm of the ovum form a barrier called the fertilization membrane around the ovum. This prevents further penetration of other sperms. Thus polyspermy (entry of more than one sperm into an egg) is prevented.

22. **What is colostrum? Write its significance.**

Ans. The mammary glands of a female secrete a yellowish fluid called colostrum during the initial days after parturition.

Significance :

(i) It has less lactose than milk and almost no fat, but it contains more proteins, vitamin A and minerals.

(ii) It is rich in IgA antibodies. It helps to protect the infants digestive tract against bacterial infections.

(iii) It is the ideal food for infants since it contains all constituents in suitable concentration and is easily digestable.

(iv) It is loaded with immune, growth and tissue repair factors.

(v) It acts as a natural antimicrobial agent to actively stimulate the maturation of the infant's immune system.

(vi) It is fully sufficient till 6 months of age for all infants.

23. Placenta is an endocrine tissue. Justify.

Ans. (i) Human embryo is surrounded by 3 embryonic membranes. The chorionic villi and uterine tissues form the disc shaped placenta. It is a temporary endocrine organ formed during pregnancy and connects the foetus to the uterine wall through the umbilical cord.

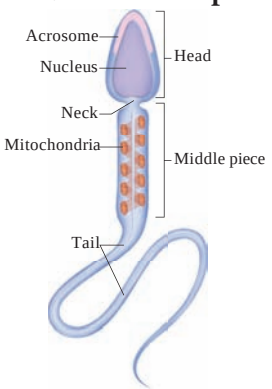
(ii) During pregnancy, the placenta acts as a temporary endocrine gland and produces large quantities of human Chorionic Gonadotropin (hCG), human Chorionic Somatomammotropin (hCS) or human Placental Lactogen (hPL), oestrogens and progesterone which are essential for a normal pregnancy.

(iii) A hormone called relaxin is also secreted during the later phase of pregnancy which helps in relaxation of the pelvic ligaments at the time of parturition. It should be noted that hCG, hPL and relaxin are produced only during pregnancy.

(iv) Thus placenta is a endocrine tissue.

24. Draw a labeled sketch of a spermatozoan.

Ans.



25. What is inhibin? State its functions.

Ans. (i) **Inhibin** is a hormone secreted by the sertoli cells in the stratified epithelium of the seminiferous tubule in the testis.

(ii) **Function:** It is involved in the negative feedback control of sperm production.

26. Mention the importance of the position of the testes in humans.

Ans. Testes are the primary male sex organs. They are a pair of ovoid bodies lying in the scrotum. The scrotum is a sac of skin that hangs outside the abdominal cavity. Since viable sperms cannot be produced at normal body temperature, the scrotum is placed outside the abdominal cavity to provide a temperature 2-3°C lower than the normal internal body temperature. Thus, the scrotum acts as a thermoregulator for spermatogenesis.

27. What is the composition of semen?

Ans. (i) Semen is a milky white fluid which contains sperms and the seminal plasma secreted from the **seminal vesicles**, **prostate gland** and **bulbourethral glands**.

(ii) The seminal plasma contains fructose sugar, ascorbic acid, prostaglandins and a coagulating enzyme called **vesiculase** which enhance sperm mobility. It also contains citrate, several enzymes and prostate specific antigens. It also provides nutrients and contains chemicals that protect and activate the sperms.

(iii) It acts as a transport medium for the sperms.

28. Name the hormones produced from the placenta during pregnancy.

Ans. Hormones produced by the placenta during pregnancy are:

(i) human Chorionic Gonadotropin (hCG)

(ii) human Chorionic Somatomammotropin (hCS)

(iii) human Placental Lactogen (hPL)

(iv) Oestrogens

(v) Progesterone

(vi) Relaxin

29. Define gametogenesis.

Ans. Gametogenesis is the process of formation of gametes i.e., sperms and ovary from the primary sex organs in all sexually reproducing organisms. Meiosis plays the most significant role in the process of gametogenesis.

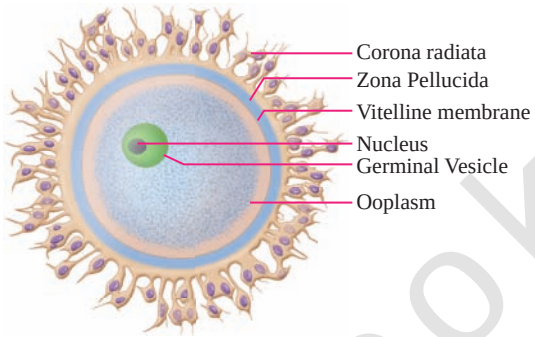
30. Describe the structure of the human ovum with a neat labelled diagram.

Ans. ***(i)*** Human ovum is non-cleidoic, alecithal and microscopic in nature.

(ii) Its cytoplasm called ooplasm contains a large nucleus called the germinal vesicle.

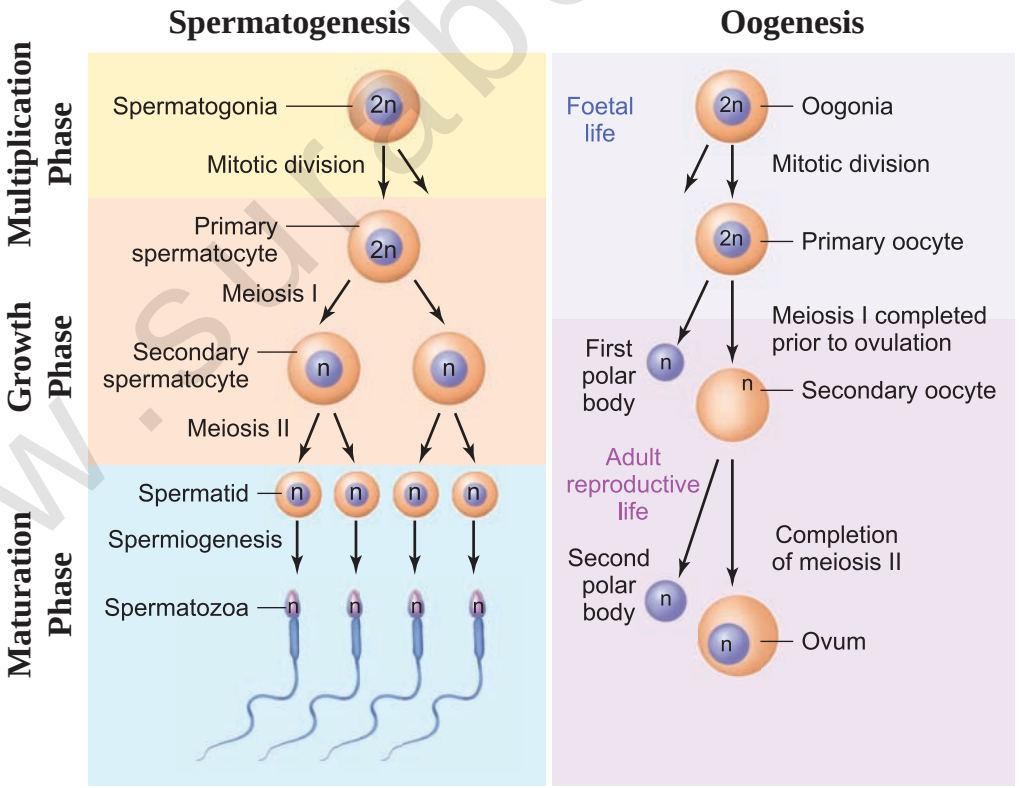
(iii) The ovum is surrounded by three coverings namely an inner thin transparent vitelline membrane, middle thick zona pellucida and outer thick coat of follicular cells called corona radiata.

(iv) Between the vitelline membrane and zona pellucida is a narrow perivitelline space.



31. Give a schematic representation of spermatogenesis and oogenesis in humans.

Ans.



32. Explain the various phases of the menstrual cycle.

Ans. Menstrual cycle comprises of the following phases

1. Menstrual phase
2. Follicular or proliferative phase
3. Ovulatory phase
4. Luteal or secretory phase

1. Menstrual phase:

(i) The cycle starts with the menstrual phase when menstrual flow occurs and lasts for 3-5 days.

(ii) Menstrual flow is due to the breakdown of endometrial lining of the uterus, and its blood vessels due to decline in the level of progesterone and oestrogen.

(iii) Menstruation occurs only if the released ovum is not fertilized.

2. Follicular or proliferative phase:

(i) The follicular phase extends from the 5th day of the cycle until the time of ovulation.

(ii) During this phase, the primary follicle in the ovary grows to become a fully mature Graafian follicle and simultaneously, the endometrium regenerates through proliferation.

(iii) These changes are induced by the secretion of gonadotropins like FSH and LH, which increase gradually during the follicular phase.

(iv) It stimulates follicular development and secretion of oestrogen by the follicle cells.

3. Ovulatory phase:

(i) Both LH and FSH attain peak level in the middle of the cycle (about the 14th day).

(ii) Maximum secretion of LH during the mid cycle called LH surge induces the rupture of the Graafian follicle and the release of the ovum (secondary oocyte) from the ovary wall into the peritoneal cavity. This process is called as ovulation.

4. Luteal or secretory phase:

(i) During luteal phase, the remaining part of the Graafian follicle is transformed into a transitory endocrine gland called corpus luteum.

(ii) The corpus luteum secretes large amount of progesterone which is essential for the maintenance of the endometrium.

(iii) If fertilisation takes place, it paves way for the implantation of the fertilized ovum.

(iv) The uterine wall secretes nutritious fluid in the uterus for the foetus. So, this phase is also called as secretory phase.

(v) During pregnancy all events of menstrual cycle stop and there is no menstruation.

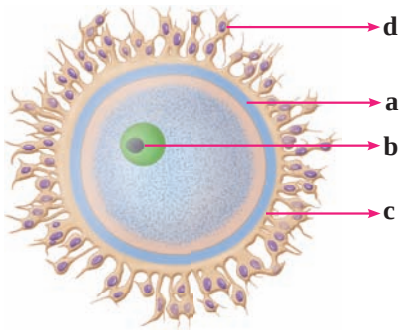
33. Explain the role of oxytocin and relaxin in parturition and lactation.

Ans. **Relaxin** – It is a hormone secreted by the placents and also found in corpus luteum. It helps in relaxation of the pelvic ligaments at the time of parturition.

(i) **Oxytocin** – It is a hormone produced by posterior lobe of pituitary gland. As pregnancy progresses, increase in oxytocin concentration promotes, uterine contractions which facilitale downward movement of the foetus. The powerful concentration of the uterine muscles leads to the expulsion of the baby through birth canal resulting in child birth or parturition.

(ii) It causes the "Let-Down" reflex - the actual ejection of milk from the alveoli of the mammary glands. During lactation, oxytocin also stimulates the recently emptied uterus to contract, helping it to return to pre - pregnancy size.

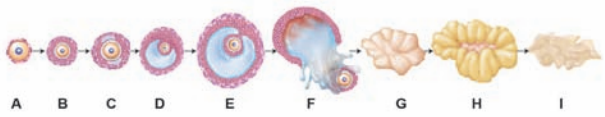
34. Identify the given image and label its parts marked as a, b, c and d



Ans. Human Ovum

a – Vitelline membrane
b – Nucleus
c – Zona Pellucida
d – Corona radiata

35. The following is the illustration of the sequence of ovarian events (a-i) in a human female.



a) **Identify the figure that illustrates ovulation and mention the stage of oogenesis it represents.**

b) **Name the ovarian hormone and the pituitary hormone that have caused the above-mentioned events.**

c) **Explain the changes that occurs in the uterus simultaneously in anticipation.**

d) **Write the difference between C and H.**

Ans. (a) The figure 'F' illustrates ovulation. It represents the maturation stage of oogenesis.

(b) The pituitary hormone leutinising hormone and the ovarian hormone oestrogen are responsible for the above mentioned events.

(c) ***(i)*** The endometrium of the uterus becomes thicker to receive the fertilized ovum in anticipation. (Implantation)

(ii) The uterine wall secretes nutritious fluid in the uterus for the foctus.

(d) 'C' indicates developmental stage of follicle in the Ovary when the ovum has not been released. 'H' indicates a stage where the ovum has been released and the remaining part of the ruptured graafian follicle has transformed into a temporary endocrine gland called corpus luteum to produce additional hormones for pregnancy.

ZOOLOGY LONG VERSION QUESTIONS (FOR PURE SCIENCE GROUP)

Q.No. 1 to 9 Refer Evaluation.

10. Painful menstruation is termed as

(a) Dysmenorrhoea (b) Menorrhagia
(c) Amenorrhoea
(d) Oligomenorrhoea

[*Ans.* (a) Dysmenorrhoea]

11. Refer Evaluation Q.No.10
12. Refer Evaluation Q.No.11
13. Refer Evaluation Q.No.12
14. Refer Evaluation Q.No.13
15. Refer Evaluation Q.No.14
16. Refer Evaluation Q.No.15
17. Refer Evaluation Q.No.16
18. Refer Evaluation Q.No.17
19. Refer Evaluation Q.No.18
20. Refer Evaluation Q.No.19
21. Refer Evaluation Q.No.20
22. Refer Evaluation Q.No.21
23. Refer Evaluation Q.No.22
24. Refer Evaluation Q.No.23
25. Refer Evaluation Q.No.24
26. Refer Evaluation Q.No.25
27. Refer Evaluation Q.No.26
28. Refer Evaluation Q.No.27
29. Refer Evaluation Q.No.28
30. Refer Evaluation Q.No.29
31. Refer Evaluation Q.No.30
32. Refer Evaluation Q.No.31
33. Refer Evaluation Q.No.32

34. List the various menstrual disorders.

Ans. (i) **Amenorrhoea :**

Absence of menstruation is called **amenorrhoea**. If menarche does not appear till the age of 18, it is called primary amenorrhoea. Absence of menstruation for over three consecutive months is secondary amenorrhoea.

(ii) **Polymenorrhoea :**

1. Polymenorrhoea is a term used to describe a menstrual cycle that is shorter than 21 days.
2. It may be due to hyperactivity of the anterior pituitary gland, psychological disturbances and malnutrition, Chronic pelvic inflammation by

certain sexually transmitted diseases (STD) such as chlamydiasis or gonorrhoea can cause inflammation in the uterus causing polymenorrhoea.

(iii) **Dysmenorrhoea :** Pain associated with menstruation is called dysmenorrhoea. There are two types

1. Primary dysmenorrhoea is pain or cramps during menstrual period.
2. Secondary dysmenorrhoea is caused by a disorder in the reproductive system like endometriosis or uterine fibroids.

(iv) **Menorrhagia :**

1. Heavy and prolonged menstrual period that disrupts a woman's normal activities is referred to as menorrhagia.
2. Menorrhagia may be due to hormonal imbalance, ovarian dysfunction, uterine fibroids and may also be due to cancer of the ovary, uterus or cervix.

(v) **Oligomenorrhoea :** Oligomenorrhoea is a condition with infrequent menstrual periods. It occurs in women of childbearing age.

35. **Refer Evaluation Q.No.33**

36. **Refer Evaluation Q.No.34**

37. **Refer Evaluation Q.No.35**

Additional Questions

Choose the Correct Answer — 1 Mark

I. Choose the Correct options for the below Questions

1. _____ are endocrine cells.
(a) Inhibitin (b) Leydig cells
(c) Oogonia (d) Sertoli cells
[*Ans.* (b) Leydig cells]

2. ___ is not linked to male reproductive system.
(a) Prostate gland
(b) Corpus albicans
(c) Cowper's gland
(d) bulbourethral glands
[*Ans.* (b) Corpus albicans]

3. Testosterone is secreted by _____
(a) spermatocytes (b) sperm
(c) polar bodies (d) leydig cells
[*Ans.* (d) leydig cells]

4. _____ is not a part of female reproductive system in human.
(a) Cervix (b) Infundibulum
(c) Isthmus (d) Prostate gland
[*Ans.* (d) Prostrate gland]

5. The _____ glands in human female are homologous to the bulbouretural glands
(a) Bartholin's glands (b) Skene's glands
(c) mammary glands (d) Cowper's gland
[*Ans.* (a) Bartholin's glands]

6. The _____ glands in human female are homologous to the prostate gland in male
(a) Bartholin's glands (b) Skene's glands
(c) mammary glands (d) Cowper's gland
[*Ans.* (b) Skene's glands]

7. _____ is popularly known as sperm lysin.
(a) Inhibitin (b) Hyaluronidase
(c) Androgen (d) Acrosome
[*Ans.* (b) Hyaluronidase]

8. The whole process of spermatogenesis takes about _____ days
(a) 25 (b) 42 (c) 64 (d) 72
[*Ans.* (c) 64]

9. The _____ is the smallest human cell.
(a) sperm (b) neuron
(c) nephron (d) alveoli
[*Ans.* (a) sperm]

10. The corpus luteum secretes large amount of _____
(a) testosterone (b) relaxin
(c) oestrogen (d) progesterone
[*Ans.* (d) progesterone]

11. _____ is not linked to polymenorrhoea
(a) Shorter cycle (b) Gland activity
(c) Malnutrition (d) Pain
[*Ans.* (d) Pain]

12. _____ may be due to cancer of the ovary
(a) Amenorrhoea (b) Dysmenorrhoea
(c) Menorrhagia
(d) Oligomenorrhoea **[Ans. (c) Menorrhagia]**

13. _____ is a berry shaped cluster of cells
(a) Blastula (b) Gastrula
(c) Morula (d) Zygote
[Ans. (c) Morula]

14. The term after birth refers to _____
(a) Parturition (b) Lactation
(c) Remains of placenta
(d) Corpus albicans
[Ans. (c) Remains of placenta]

15. 'Let Down' reflex for lactation is caused by ___
(a) Prolactin (b) Oxytocin
(c) Lactogenic hormone (d) Progesterone
[Ans. (b) Oxytocin]

16. Among the extra embryonic membranes the _____ is the outer most membrane
(a) amnion (b) chorion
(c) allantois
(d) vitelline membrane **[Ans. (b) chorion]**

17. The dividing embryo takes _____ days to move to the uterus from the fallopian tube
(a) 10 (b) 15 (c) 4-5 (d) 2
[Ans. (c) 4-5]

18. Capacitation is a _____ event
(a) physical (b) biochemical
(c) both a and c
(d) Enzyme mediated
[Ans. (b) biochemical]

II. Choose the Correct Options for the Below Fill in the Blanks

1. The transfer of sperms by the male into the female genital tract is called _____
(a) implantation (b) parturition
(c) insemination (d) gastrulation
[Ans. (c) insemination]

2. Attachment of blastocyst to the uterine wall is called_____.
(a) Implantation (b) Parturition
(c) Insemination (d) gastrulation
[Ans. (a) Implantation]

3. Expulsion of baby from the mother's womb is called _____.
(a) implementation (b) parturition
(c) insemination (d) gestation
[Ans. (b) parturition]

4. Each testis is covered by a fibrous layer _____.
(a) tubulus rectus (b) corona radiata
(c) vitelline membrane (d) tunica albuginea
[Ans. (d) tunica albuginea]

5. The scrotum acts as _____ for spermatogenesis.
(a) chemoregulator (b) thermoregulator
(c) enzyme regulator (d) photo regulator
[Ans. (b) thermoregulator]

6. The _____ is the site for spermatogereis.
(a) epididymis (b) vas deferens
(c) seminiferous tubules (d) tubulus rectus
[Ans. (c) seminiferous tubules]

7. _____ cells nourish the sperms.
(a) Leydig cells (b) Interstitial cells
(c) Spermatogonic cells (d) Sertoli cells
[Ans. (d) Sertoli cells]

8. _____ is a hormone produced by sertoli cells.
(a) Inhibin (b) Progesterone
(c) Testosterone (d) Oestrogen
[Ans. (a) Inhibin]

9. The _____ cells of the testis are endocrine in nature.
(a) sertoli (b) leydig
(c) nurse
(d) spermatogonic **[Ans. (b) leydig]**

10. The male hormones are called _____.
(a) estrogen (b) progesterone
(c) relaxin (d) androgens
[Ans. (d) androgens]

11. _____ stores the sperms temporarily until they mature.
(a) testis (b) epididymis
(c) vasa efferentia (d) vas deferens
[Ans. (b) epididymis]

12. Bulbourethral glands are also called _____.
(a) prostate gland (b) Cowper's gland
(c) Skene's glands (d) Bartholin's glands
[Ans. (b) Cowper's gland]

13. The seminal fluid has a coagulating enzyme called _____.
(a) vesiculase (b) hyaluronidase
(c) amylase (d) lactase
[Ans. (a) vesiculase]

14. The proximal part of the fallopian tube bears a funnel shaped _____.
(a) Graafian follicle (b) Oogonia
(c) Infundibulum (d) corpus luteum
[Ans. (c) Infundibulum]

15. The finger shaped _____ in the female reproductive system collect the ovum after ovulation.
(a) Infundibulum (b) Fimbriae
(c) Ampulla (d) Isthmus
[Ans. (b) Fimbriae]

16. _____ is the birth canal.
(a) Cervix (b) Cervical canal
(c) Uterus (d) Vagina
[Ans. (d) Vagina]

17. A mature follicle produces _____ polar bodies during oogenesis.
(a) four (b) three (c) two (d) one
[Ans. (b) three]

18. The _____ glands occur posterior to the vagina.
(a) Skene's glands (b) Cowper's gland
(c) prostate gland (d) Bartholin's glands
[Ans. (d) Bartholin's glands]

19. The _____ glands are located on the anterior wall of vagina.
(a) Skene's glands (b) Bartholin's glands
(c) prostate gland (d) Cowper's gland
[Ans. (a) Skene's glands]

20. The thin ring of tissue that particularly closes the vaginal opening_____.
(a) labia majora (b) hymen
(c) labia minora (d) clitoris
[Ans. (b) hymen]

21. The _____ are modified sweat gland seen in both sexes.
(a) Skene's glands (b) Bartholin's glands
(c) Mammary gland (d) Cowper's gland
[Ans. (c) Mammary gland]

22. The spermatids are transformed into mature sperms by a process called _____.
(a) spermiation (b) spermiogenesis
(c) gametogenesis (d) oogenesis
[Ans. (b) spermiogenesis]

23. Sperms are released into the cavity of the seminiferous tubule by a process called _____.
(a) spermiogenesis (b) spermatogenesis
(c) spermiation (d) gametogenesis
[Ans. (c) spermiation]

24. The unequal divisions during oogenesis results in small cells called _____.
(a) oogonia (b) primary oocyte
(c) secondary oocyte (d) polar bodies
[Ans. (d) polar bodies]

25. Normal menstrual or ovarion cycle occurs once in _____ days.
(a) 28/29 (b) 17/18
(c) 60/65 (d) 58/60
[Ans. (a) 28/29]

26. The ruptured Graafian follicle forms _____.
(a) corpus luteum (b) primary follicle
(c) oogonia (d) secondary follicle
[Ans. (a) corpus luteum]

27. LH surge is seen in _____ phase of menstrual cycle.
(a) follicular phase (b) luteal phase
(c) ovulatory (d) menstrual
[Ans. (c) ovulatory]

28. _____ is a temporary endocine gland formed during pregnancy from the follicle.
(a) oestrogen (b) corpus luteum
(c) progesterone (d) relaxin
[Ans. (b) corpus luteum]

29. The _____ phase of menstrual cycle is also called secretory phase.
(a) Ovulatory (b) Menstrual
(c) Luteal (d) Follicular
[Ans. (c) Luteal]

30. _____ is a biochemical event which enables a sperm to fertilize an egg.
(a) Capacitation (b) Gastrulation
(c) Spermiogenesis (d) Gametogenesis
[Ans. (a) Capacitation]

31. The follicular cells of the ovum are held together by a substance called _____.
(a) hyaluronidase (b) progesterone
(c) oestrogen (d) hyaluronic acid
[*Ans.* (d) hyaluronic acid]

32. The _____ prevents poly spermy.
(a) vitelline membrane
(b) fertilization membrane
(c) zona pellucida
(d) corona radiata
[*Ans.* (b) fertilization membrane]

33. The stage where the embryo looks like a fluid filled hollow ball is called _____.
(a) trophoblast (b) morula
(c) gastrula (d) blastocyst
[*Ans.* (d) blastocyst]

34. The ____ is a double layered embryonic membrane.
(a) chorion (b) amnion
(c) allantois (d) yolksac
[*Ans.* (b) amnion]

35. Human pregnancy lasts for _____ days.
(a) 280 (b) 300 (c) 290 (d) 310
[*Ans.* (a) 280]

36. _____ connects the foetus and maternal tissues.
(a) Chorionic villi (b) Uterus
(c) Placenta (d) Corpus albicans
[*Ans.* (c) Placenta]

37. The ___ contractions lead to false labour pains.
(a) Let - Down reflex (b) Ferguson reflex
(c) Foetal ejection reflex (d) Braxter - Hicks
[*Ans.* (d) Braxter - Hicks]

38. The foetal ejection reflex is also called _____ reflex.
(a) Ferguson (b) Let - Down
(c) Braxter - Hicks (d) Parturition
[*Ans.* (a) Ferguson]

39. _____ is a hormone secreted by the placenta and also found in the corpus luteum
(a) Oxytocin (b) Relaxin
(c) Inhibin (d) Testosterone
[*Ans.* (b) Relaxin]

40. The hormone _____ brings about powerful contraction of uterine muscles during child birth
(a) Relaxin (b) Oestrogen
(c) Progesterone (d) Oxytocin
[*Ans.* (d) Oxytocin]

41. The hormone _____ produced by anterior pituitary plays a major role in lactation.
(a) oxytocin (b) prolactin
(c) progesterone (d) oestrogen
[*Ans.* (b) prolactin]

42. Colostrum has less _____ than milk.
(a) protein (b) minerals
(c) lactose (d) vitamin A
[*Ans.* (c) lactose]

43. _____ is a natural antimicrobial agent to stimulate the maturation of infants immune system.
(a) IgA antibodies (b) Amniotic fluid
(c) Milk (d) Colostrum
[*Ans.* (d) Colostrum]

44. _____ is the first ejaculation of semen.
(a) Azospermia (b) Spermarche
(c) Prostatits
(d) Orchidectomy [*Ans.* (b) Spermarche]

III. Identify the correct Statements

1. (i) Fertilization occurs after acrosomal reaction.
(ii) Placenta is an temporary exocrine gland formed during pregnancy
(iii) Ectopic pregnancy can lead to death
(iv) Ferguson reflex creates fake labour
(a) i and iii (b) i, iii and iv
(c) ii and iv (d) ii & iii
[*Ans.* (a) i and iii]

2. (i) PPL helps in lactation
(ii) hCS helps in fertilization
(iii) Egg is the largest human cell
(iv) 14th day of menstrual cycle is the ovulatory phase
(a) i, iv (b) ii and iii
(c) I, ii and iv (d) i, iii, iv
[*Ans.* (d) i, iii, iv]

III. Identify the Wrong Statements

1. (i) For fertilization to occur, the egg must be transported earlier to the fallopian tube.
(ii) Twins are formed because fertilization membrane is formed later.
(iii) Binding of sperms to receptor molecules in zona. Pellucida is seen during fertilization
(iv) Morula is formed before blastocyst

(a) All the above (b) i, iii and iv
(c) i and ii (d) ii and iv

[*Ans.* (c) i and ii]

2. (i) Testis acts as a thermoregulator.
(ii) Seminal vesicles secrete an acidic fluid
(iii) Vesiculase is a enzyme in seminal fluid
(iv) Hymen can get disrupted due to physical exercises.

(a) All the above (b) i and ii
(c) iii and ii (d) i, iv and ii

[*Ans.* (b) i and ii]

IV. Match the following

1.

1.	Hyaluronidase	(a)	Interstitial cells
2.	Vesiculase	(b)	Sertoli cells
3.	Testosterone	(c)	Acrosomal reaction
4.	Inhibin	(d)	Seminal vesicle

(A) 1 – a 2 – b 3 – d 4 – c
(B) 1 – c 2 – d 3 – a 4 – b
(C) 1 – c 2 – a 3 – d 4 – b
(D) 1 – a 2 – d 3 – c 4 – b

[*Ans.* (B) 1-c 2-d 3-a 4-b]

2.

1.	Corpus luteum	(a)	secretory phase
2.	Skene's gland	(b)	follicle
3.	Uterus	(c)	Leutinising hormone
4.	Ovulation	(d)	Prostate gland

(A) 1 – d 2 – a 3 – c 4 – b
(B) 1 – a 2 – c 3 – d 4 – b
(C) 1 – b 2 – d 3 – c 4 – a
(D) 1 – b 2 – d 3 – a 4 – c

[*Ans.* (D) 1-b 2-d 3-a 4-c]

V. Identify the correct assertion and reason

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. A and R are true, R is the correct explanation of A
B. A and R are true, R is not the correct explanation of A
C. A is true, R is false
D. Both A and R are false

1. Assertion : The primary germ layers are formed during gastrulation.
Reason : The body organs are formed from primary germ layers.

[*Ans.* (a) A and R are true, R is the correct explanation of A]

2. Assertion : The process of oogenesis must get completed before fertilization
Reason : The egg after II Meiosis is ready for fertilization.

[*Ans.* (D) Both A and R are false]

3. Assertion : By 36th week, the baby is positioned into pelvis for parturition
Reason : The Braxter –Hick's contractions will begin for parturition.

[*Ans.* (C) A is true but R is false]

VI. Identify the Correct pair from the below

1. (i) Mammary gland – areola
(ii) Sperms – Relaxin
(iii) polar body – 46 chromosmes
(iv) Middle piece – ATP

(a) i and iv (b) ii and iv
(c) i, ii and iv (d) ii and iii

[*Ans.* (a) i and iv]

2. (i) Amenorrhoea – Short cycle
(ii) Dysmenorrhoea – Uterine fibroids
(iii) Oligomenorrhoes – Pain
(iv) Polymenorrhoea – Psychological disturbances

(a) i, ii and iv (b) ii and iii
(c) ii and iv (d) i, ii and iii

[*Ans.* (c) ii and iv]

VIII. Identify the Incorrect pair from the below

1. (i) Dizygotic twins – Two sperms
   (ii) Epiblast – Gastrula
   (iii) Amnion – Umbilical cord
   (iv) Colostrum – I g A antibodies
   (a) i, ii and iv (b) i and iv
   (c) iii and iv (d) ii and iii
   [Ans. (d) ii and iii]

2. (i) Ovary – Cryptorchism
   (ii) Nurse cells – Seminiferous tubules
   (iii) Gametogenesis – Meiosis
   (iv) GnRH – Lactation
   (a) i, iii and iv (b) ii and iv
   (c) i and iv (d) iii only
   [Ans. (c) i and iv]

IX. Identify the Odd-man out from the below

1. (a) Skene's glands (b) endometrium
   (c) mammary glands (d) Fallopian tube
   [Ans. Mammary glands]
   Reason: They occur in both sexes but the others are found only in female reproductive system.

2. (a) Lutenizing hormone (b) Oxytocin
   (c) Progestrone (d) Hyaluronic acid
   [Ans. Hyaluronic acid]
   Reason: It is not a hormone whereas the other three are hormones.

3. (a) Axoneme (b) Mitochondria
   (c) acrosome
   (d) fertilization membrane
   [Ans. fertilization membrane]
   Reason: It is not a part of the sperm whereas the others are parts of sperm

4. (a) Polar body (b) Primary follicle
   (c) Secondary follicle (d) Spermatogonia
   [Ans. Spermatogonia]
   Reason: It is associated with male reproductive system whereas the others are associated with female reproductive system.

5. (a) Menarche (b) amenorrhoea
   (c) Gonorrhoea (d) Menorrhagia
   [Ans. Gonorrhoea]
   Reason: It is a sexually transmitted disease and the others are related to menstrual cycle.

Answer in one word*

1. The inner glandular layer of the uterus is called _____. [Ans. endometrium]
2. The acrosome is formed from _____. [Ans. Golgi body]
3. The cap like pointed tip of a sperm is called _____ [Ans. acrosome]
4. The middle piece of the sperm contains _____ [Ans. mitochondria]
5. The acrosome contains the enzyme _____. [Ans. Hyaluronidase]
6. A mature ovarion follicle is called _____. [Ans. graafian follicle]
7. The outer thick coat covering ovum is called _____. [Ans. corona radiata]
8. Puberty is also called _____. [Ans. menarche]
9. Menstruation does not occur during _____. [Ans. pregnancy]
10. Release of ovum from follicle is called _____. [Ans. ovulation]
11. When the corpus luteum. degenerates it leaves a scar tissue called _____. [Ans. corpus albicans]
12. Absence of menstruation is called _____. [Ans. Amenorrhoea]
13. A menstrual cycle that is shorter is called _____. [Ans. Polymenorrhoea]
14. Pain associated with menstruation is called _____. [Ans. Dysmenorrhoea]
15. Heavy and prolonged menstrual period is called_____. [Ans. Menorrhagia]
16. Infrequent menstrual period is called _____. [Ans. Oligomenorrhoea]
17. The ecofriendly way to destroy sanitary napkins are by use of _____. [Ans. incinerator]

* Only for quick revision not in pattern

18. Colostrum does not contain_____. [Ans. fat]

19. Failure of spermatogenesis is called _____. [Ans. azospermia]

20. Surgical removal of testis is called_____. [Ans. Orchidectomy]

21. The mitochandrial spiral in middle piece of sperm is called _____. [Ans. Nebenkern]

Very Short Answers 2 Marks

1. Define Gametogenesis.

Ans. Formation of gametes in males and females by spermatogenesis and oogenesis respectively.

2. Define Insemination.

Ans. Transfer of sperms by the male into the female genital tract is called Insemination.

3. Define fertilisation.

Ans. Fusion of male and female gametes to form zygote, is called fertilisation.

4. Define Cleavage.

Ans. Cleavage refers to the rapid mitotic divisions of the zygote which convert the single celled zygote into a multicellular structure called blastocyst.

5. Define Implantation.

Ans. Attachment of blastocyst to the uterine wall is called Implantation.

6. What is Placentation?

Ans. The process of formation of placenta which is the intimate connection between foetus and uterine wall of the mother for exchange of nutrients is called Placentation.

7. What is Gastrulation?

Ans. It is a process by which blastocyst is changed into a gastrula with three primary germ layers, namely ectoderm, endoderm and mesoderm.

8. What is Organogenesis?

Ans. Formation of specific tissues, organs and organ systems from three germ layers is called Organogenesis.

9. What is Parturition?

Ans. Expulsion of the baby from the mother's womb is called Parturition.

10. Name the types of cells found in seminiferous tubule.

Ans. (i) Sertoli cells or nurse cell
(ii) Spermatogonic cells.

11. What are leydig cells?

Ans. (i) Leydig cells or Interstitial cells are found in soft connective tissue surrounding the seminiferous tubules of tests and are endocrine in nature.
(ii) They secrete androgens namely testosterone. Hormone which initiates the process of spermatogenesis.

12. Name the accessory ducts associated with male reproductive system.

Ans. The accessory ducts associated with the male reproductive system include rete testis, vasa efferentia, epididymis and vas deferens

13. What is the significance of epididymis?

Ans. (i) The epididymis is a single highly coiled tube that temporarily stores the spermatozoa and they undergo physiological maturation and acquire increased motility and fertilizing capacity.
(ii) It is found in the testis.

14. Name the accessory glands of the male reproductive system.

Ans. The accessory glands of the male reproductive system include the paired seminal vesicles and bulbourethral glands also called Cowper's gland and a single prostate gland.

15. What is the function of seminal fluid?

Ans. The seminal fluid acts as a transport medium, provides nutrients, contains chemicals that protect and activate the sperms and also facilitate their movement.

16. Name the accessory organs of the female reproductive system.

Ans. The fallopian tubes (uterine tubes or oviducts), uterus and vagina constitute the female accessory organs.

17. Describe the location and shape of the uterus.

Ans. The uterus or womb is a hollow, thick-walled, muscular, highly vascular and inverted pear shaped structure lying in the pelvic cavity between the urinary bladder and rectum.

18. What is endometrium?

Ans. *(i)* The inner glandular layer of the uterus is called endometrium.

(ii) The endometrium undergoes cyclic changes during the menstrual cycle.

19. Name the glands associated with female reproductive hyster.

Ans. Bartholins glands and skene's glands

20. Define spermiogenesis.

Ans. The spermatids are transformed into mature spermatozoa (sperms) by the process called spermiogenesis.

21. What is spermiation?

Ans. Sperms are finally released into the cavity of seminiferous tubules by a process called spermiation. It follows spermiogenesis.

22. What is ovulation?

Ans. The release of ovum by the rupture of the Graafian follicle is called ovulation. It occurs during ovulatory phase of menstrual cycle.

23. What is Morula?

Ans. Following fertilization, after 72 hours, a loose collection of cells is formed from the zygote by cleavage. The berry shaped cluster of 16 or more cells is called morula.

24. What is ectopic pregnancy?

Ans. *(i)* If the fertilised ovum is implanted outside the uterus it results in ectopic pregnancy.

(ii) The growth of the embryo may cause internal bleeding, infection and in some cases even death due to rupture of the fallopian tube.

25. Name the extra embryonic membranes.

Ans. Amnion, yolk sac, allantois and chorion

26. What is the function of yolk sac in a human embryo?

Ans. The yolk sac forms a part of the gut and is the source of the earliest blood cells and blood vessels.

27. What is after birth?

Ans. The placenta along with the remains of the umbilical cord called "after birth" is expelled out after delivery.

28. What is abdominal delivery or Caesarean section?

Ans. When normal vaginal delivery is not possible due to factors like position of the baby and nature of the placenta, the baby is delivered through a surgical incision in the woman's abdomen and uterus. It is also termed as abdominal delivery or Caesarean Section or 'C' Section.

29. What is "Let – Down" reflex?

Ans. The hormone oxytocin brings about the "Let - down" reflex which is the actual ejection of milk from the alveoli of the mammary glands.

30. What is azospermia?

Ans. Azospermia refers to the failure of spermatogenesis. It is seen in males.

31. What is orchidectomy?

Ans. Castration or surgical removal of testis is known as orchidectomy.

32. What are the initiatives taken by the Government of Tamilnadu to highlight the importance of Breast feeding?

Ans. The Government of Tamil Nadu has also initiated various projects like Mother's Milk Bank, Feeding rooms in bus terminals and also organizes awareness campaigns during the first week of August to highlight the importance of breast feeding to infants.

33. What are the functions of centrioles in the sperm?

Ans. *(i)* The proximal centriole lies towards the nucleus and plays a role in the first division of the zygote.

(ii) Distal centriole gives rise to axial filament of the sperm.

34. What is the function of middle piece of sperm?

Ans. It contains mitochondria and produces energy in the form of ATP molecules for the movement of sperm.

SHORT ANSWERS — 3 Marks

1. What is the function of Sertoli cells?

Ans. *(i)* Sertoli cells are elongated and pyramidal and provide nourishment to the sperms till maturation.

(ii) They also secrete inhibin, a hormone which is involved in the negative feedback control of sperm production.

2. What is the role of FSH & LH in spermatogenesis?

Ans. *(i)* FSH stimulates testicular growth and enhances the production of Androgen Binding Protein (ABP) by the sertoli cells and helps in the process of spermiogenesis.

(ii) LH acts on the Leydig cells and stimulates the synthesis of testosterone which in turn stimulates the process of spermatogenesis.

3. What is acrosome?

Ans. *(i)* Acrosome is a small cap like pointed structure present at the tip of the nucleus and is formed mainly from the Golgi body of the spermatid.

(ii) It contains hyaluronidase, a proteolytic enzyme, popularly known as sperm lysin which helps to penetrate the ovum during fertilisation.

4. What is LH surge?

Ans. During the ovulatory phase of the menstrual cycle, maximum secretion of leutinising hormone occurs during the mid cycle (about 14th day) which is called LH surge and induces ovulation.

5. What is corpus luteum?

Ans. *(i)* It is a temporary endocrine gland formed from the ruptured Graafian follicle.

(ii) It secretes a large amount of progesterone which is essential for maintenance of the endometrium of the uterus. If fertilization does not occur it degenerates.

6. Why does menstrual flow occur?

Ans. *(i)* Menstrual flow occurs due to breakdown of endometrial lining of the uterus and its blood vessels due to decline in the level of progesterone and oestrogen.

(ii) This happens when the released ovum is not fertilized.

7. What is secretory phase of menstrual cycle?

Ans. *(i)* The Luteal phase of menstrual cycle involves formation of corpus luteum and thickening of endometrium of uterus for implantation.

(ii) The uterine wall secretes nutritious fluid for the foetus. So the phase is called secretory phase.

8. What is polymenorrhoea?

Ans. It denotes a menstrual cycle that is shorter than 21 days which may be due to hyperactivity of anterior pituitary gland, psychological disturbances, malnutrition, sexually transmitted disease etc.

9. What is menorrhagia?

Ans. *(i)* Heavy and prolonged menstrual period that disrupts a woman's normal activities is referred to as menorrhagia.

(ii) Menorrhagia may be due to hormonal imbalance, ovarian dysfunction, uterine fibroids and may also be due to cancer of the ovary, uterus or cervix.

10. What is menopause?

Ans. *(i)* Menopause is the phase in a women's life when ovulation and menstruation stops.

(ii) The average age of menopause is 45-50 years. It indicates the permanent cessation of the primary functions of the ovaries.

11. What is acrosome reaction?

Ans. *(i)* During fertilization the acrosomal membrane of the sperm releases the proteolytic enzyme called hyaluronidase to break the hyaluronic acid which binds the follicular cells around the ovum.

(ii) This is called acrosome reaction. This helps the sperm to enter the ovum.

12. Name the different types of twins formed.

Ans. *(i)* Monozygotic twins – single fertilized egg splits into two embryos. The individuals are of the same sex, look alike and share the same genes.

(ii) Dizygotic twins – Two eggs are fertilized by two sperms. The two individuals may or may not be of same sex and are non-identical.

(iii) Siamese twins – conjoined twins joined during birth.

13. What is the function of amnion?

Ans. *(i)* The amnion is a double layered translucent membrane filled with the amniotic fluid.

(ii) It provides a buoyant environment to protect the developing embryo from injury, regulates the temperature of the foetus and provides a medium in which the foetus can move.

14. What is the significance of allantois?

Ans. *(i)* The allantois is an extra embryonic membrane which forms a small out pocketing of embryonic tissue at the caudal end of the yolk sac.

(ii) It is the structural base for the umbilical cord that links the embryo to the placenta and ultimately it becomes part of the urinary bladder.

15. What are Braxter-Hick's contractions?

Ans. *(i)* Throughout pregnancy the uterus undergoes periodic episodes of weak and strong contractions.

(ii) These contractions called Braxter-Hick's contractions lead to false labour.

16. What is Ferguson reflex?

Ans. *(i)* During parturition the descent of the foetus causes dilation of cervix of the uterus and vaginal canal resulting in a neurohumoral reflex called Foetal ejection reflex or Ferguson reflex.

(ii) This initiates the secretion of oxytocin from the neurohypophysis which in turn brings about the powerful contraction of the uterine muscles and leads to the expulsion of the baby through the birth canal.

17. What is Relaxin?

Ans. *(i)* Relaxin is a hormone secreted by the placenta and also found in the corpus luteum.

(ii) It promotes parturition by relaxing the pelvic joints and by dilatation of the cervix with continued powerful contractions.

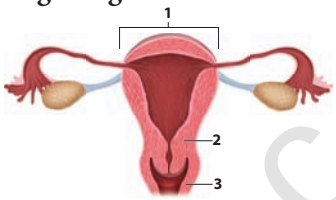
18. What is Capacitation?

Ans. The sperms deposited in the female reproductive tract undergo capacitation, which is a biochemical event that enables the sperm to penetrate and fertilise the egg.

19. What is Polycystic ovary syndrome (PCOS)?

Ans. PCOS is a complex endocrine system disorder that affects women in their reproductive years. Polycystic means 'many cysts'. It refers to many partially formed follicles on the ovaries, which contain an egg each. But they do not grow to maturity or produce eggs that can be fertilized. Women with PCOS may experience irregular menstrual cycles, increased androgen levels, excessive facial or body hair growth (hirsutism), acne, obesity, reduced fertility and increased risk of diabetes. Treatment for PCOS includes a healthy lifestyle, weight loss and targeted hormone therapy.

20. In the diagram given below



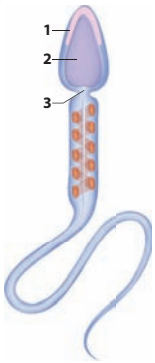
(a) Label the parts and

(b) Identify the name of the diagram.

Ans. (a) 1 – Uterus 2 – Cervix 3 – Vagina

(b) The given diagram is identified as Female Reproductive system of Human

21. In the diagram given below.



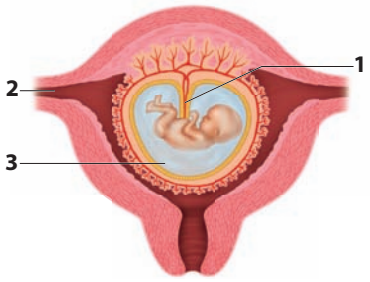
(a) Identify the diagram

(b) Label the parts indicated.

Ans. **(a)** Human Sperm

(b) 1 – Acrosome 2 – Nucleus 3 – Neck

22. In the diagram given below



(a) Identify the diagram

(b) Label the parts

Ans. (a) Human foetus within the uterus

(b) 1 – Umbilical cord
2 – Fallopian tube
3 – Amniotic fluid

Long Answers — 5 Marks

1. Differentiate Spermatogenesis and oogenesis.

Spermatogenesis	Oogenesis
It takes place in the seminiferous tubules of testis	It occurs in the follicles of the ovary
It begins at puberty in males.	In females it initiates in the foetal stages.
Spermatogonia are the sperm mother cells and many of them undergo maturation phase to form sperms.	Oogonia is the the egg mother cell and only one cell undergoes maturation phase at a time except in cases of fraternal twins.
I & II Mieotic divisions are equal and each spermatogonia forms 4 haploid spermatids.	I & II meiotic divisions are unequal and finally only one haploid ovum and 3 small haploid polar bodies are formed
The spermatids undergo a stage called Spermiogenesis to become functional sperm.	No such changes are observed.
The meiotic divisions are completed and spermaticly are formed.	The second meiotic division is never completed it fertilization does not take place.

3. Describe the structure of a sperm

Ans. **Structure of human spermatozoan**

(i) The human sperm is a microscopic, flagellated and motile gamete. The whole body of the sperm is enveloped by plasma membrane and is composed of a head, neck and a tail.

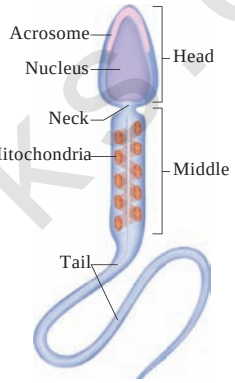
(ii) The head comprises of two parts namely acrosome and nucleus.

(iii) Acrosome is a small cap like pointed structure present at the tip of the nucleus and is formed mainly from the golgi body of the spermatid.

(iv) It contains hyaluronidase, a proteolytic enzyme, popularly known as sperm lysin which helps to penetrate the ovum during fertilisation.

(v) The neck is very short and is present between the head and the middle piece. It contains the proximal centriole towards the nucleus which plays a role in the first division of zygote and the distal centriole gives rise to the axial filament of the sperm.

(vi) The middle piece possesses mitochondria spirally twisted around the axial filament called mitochondrial spiral or nebenkern. It produces energy in the form of ATP molecules for the movement of sperms.



Structure of human sperm

(vii) The tail is the longest part of the sperm and is slender and tapering.

(viii) It is formed of a central axial filament or axoneme and an outer protoplasmic sheath. The lashing movements of the tail push the sperm forward.

4. Explain the process of fertilization in human beings.

Ans. *(i)* Fertilisation occurs when a haploid sperm fuses with a haploid ovum to form a fertilized egg or diploid zygote.

(ii) The sperms deposited in the female reproductive tract undergo capacitation, which is a biochemical event that enables the sperm to penetrate and fertilise the egg.

(iii) Fertilisation occurs only if the ovum and sperms are transported simultaneously to the ampullary isthmic junction of the fallopian tube.

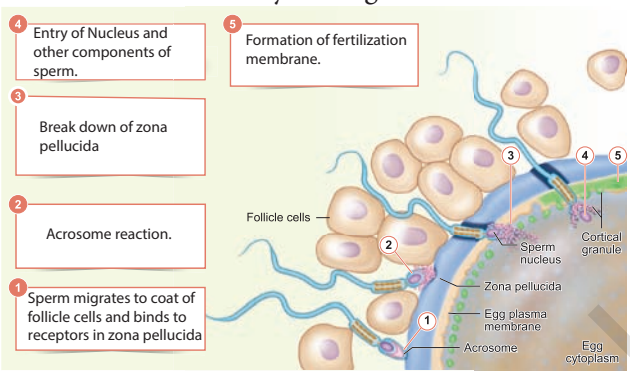
(iv) Before a sperm can enter the egg, it must penetrate the multiple layers of granulosa (follicular) cells which are around the ovum forming the corona radiata. The follicular cells are held together by an

adhesive cementing substance called hyaluronic acid.

(v) The acrosomal membrane disintegrates releasing the proteolytic enzyme, hyaluronidase during sperm entry through the corona radiata and zona pellucida. This is called acrosomal reaction.

(vi) Once fertilisation is accomplished, cortical granules from the cytoplasm of the ovum form a barrier called the fertilisation membrane around the ovum preventing further penetration of other sperms. Thus polyspermy is prevented.

This is followed by cleavage



Events of fertilisation

5. Write a note a extra embryonic membranes.

Ans. The extra embryonic membranes namely the amnion, yolk sac, allantois and chorion protect the embryo from dessication, mechanical shock and help in the absorption of nutrients and exchange of gases.

Amnion

The amnion is a double layered translucent membrane filled with the amniotic fluid. It provides a buoyant environment to protect the developing embryo from injury, regulates the temperature of the foetus and provides a medium in which the foetus can move.

Yolk sac:

The yolk sac forms a part of the gut and is the source of the earliest blood cells and blood vessels.

Allantois:

The allantois is an extra embryonic membrane which forms a small out pocketing of embryonic tissue at the caudal end of the yolk sac. It is the structural base for the umbilical cord that links the embryo to the placenta and ultimately it becomes part of the urinary bladder.

Chorion:

The chorion is the outermost membrane which encloses the embryo and all other membranes and also helps in the formation of the placenta.

Chorionic Villi:

The trophoblast cells in the blastocyst send out several finger like projections called chorionic villi carrying foetal blood and are surrounded by sinuses that contain maternal blood. The chorionic villi and the uterine tissues form the disc-shaped placenta.

Placenta:

Placenta is a temporary endocrine organ formed during pregnancy and it connects the foetus to the uterine wall through the umbilical cord. It is the organ by which the nutritive, respiratory and excretory functions are fulfilled.

HOTS

1. In females a oogonia forms a single ovum only. What is the significance of the oogonia undergoing meiosis I & II when in a male, each spematogonia forms 4 sperms.

Ans. The meiotic divisions I & II take place in order to ensure that the ovum is haploid since normal chromosomal number is important for formation of normal zygote. Further polar bodies have less cellular contents and are small since they do not participate in fertilization most of the cellular contents lie in the ovum.

2. Menstruation does not occur during pregnancy give reason.

Ans. Pregnancy begins soon after the formation of zygote after fertilization.

Following this the uterus, accessory organs and glands of female reproductive system get ready to receive the zygote and nourish it.

Menstruation occurs by disintegration of the uterine wall and corpus luteum, if fertilization has not occurred. Therefore during pregnancy menstruation ceases and this continues till parturition or child birth.

Unit Test

Time : 1 hr] [Marks: 25

I. Choose the Correct Answer 10×1 = 10

1. The foetal membrane that forms the basis of the umbilical cord is
(a) Allantois (b) Amnion
(c) Chorion (d) Yolk sac

2. The Androgen Binding Protein (ABP) is produced by
(a) Leydig cells (b) Hypothalamus
(c) Sertoli cells (d) Pituitary gland

3. _____ is popularly known as sperm lysin
(a) Inhibitin (b) Hyaluronidase
(c) Androgen (d) Acrosome

4. Identify the correct pair from the below.
(i) Mammary gland – Areola
(ii) Sperms – Relaxin
(iii) Polarbody – 46 chromosmes
(iv) Middle piece – ATP
(a) i and iv (b) ii and iv
(c) i, ii and iv (d) ii and iii

5. Identify the wrong statement from the below.
(i) Testis acts as a thermoregulator.
(ii) Seminal vesicles secrete an acidic fluid
(iii) Vesiculase is a enzyme in seminal fluid
(iv) Hymen can get stretched due to physical exercises.
(a) All the above (b) i and ii
(c) iii and ii (d) i, iv and ii

6. Which one of the following menstrual irregularities are correctly matched?
(a) Menorrhagia - excessive menstruation
(b) Amenorrhoea - absence of menstruation
(c) Dysmenorrhoea - irregularity of menstruation
(d) Oligomenorrhoea - painful menstruation

7. _____ is a berry shaped cluster of cells
(a) Blastula (b) Gastrula
(c) Morula (d) Zygote

8. **Assertion :** By 36th week, the baby is positioned into pelvis for parturition.
Reason : The Braxter – Hick's contractions will begin for parturition.
(a) A and R are true, R is the correct explanation of A
(b) A and R are true, R is not the correct explanation of A
(c) A is true, R is false
(d) Both A and R are false

9. Choose the odd man out
(a) Skene's glands (b) Endometrium
(c) Mammary glands (d) Fallopian tube

10. The _____ glands in human female are homologous to the prostate glands in male
(a) Bartholins glands (b) skene's glands
(c) mammary glands (d) cowper's glands

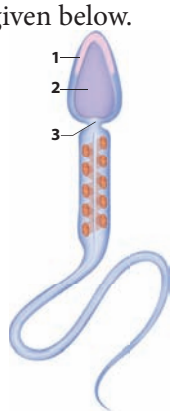
II. Very Short Answer 2×2 = 4

11. What is placenta?

12. Mention the significance of location of testis.

III. Short Answer 2×3 = 6

13. In the diagram given below.



(a) Identify the diagram
(b) Label the parts indicated.

14. What is the function of yolk sac?

IV. Long Answer 1×5 = 5

15. List the differences between spermatogenesis and oogenesis.

(OR)

Write a note on menstrual cycle.

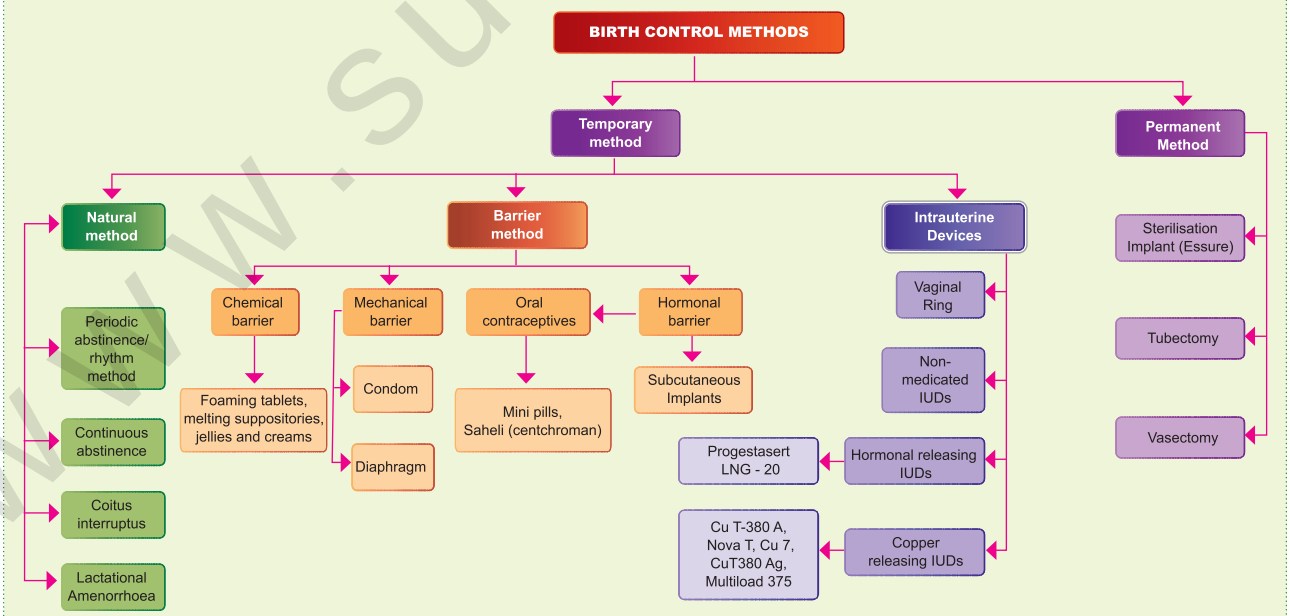
UNIT I

Chapter 3

REPRODUCTIVE HEALTH

CHAPTER SNAPSHOT

Concept Map



MUST KNOW DEFINITIONS

Female foeticide	:	Aborting the female in the mother's womb.
Female infanticide	:	Female infanticide is 'killing the female child after her birth.
PCPNDT Act	:	Preconception and prenatal diagnostic technique act.
POCSO Act	:	Prevention of children from sexual offences.
Birth control	:	Voluntary use of Contraceptive procedures to prevent fertilization.
Lactational amenorrhea	:	Delay in ovarian cycles due to lactation.
Barrier method of contraception	:	Ovum and sperm are prevented from meeting to prevent fertilization
Tubectomy	:	Surgical Sterilisation in women
Vasectomy	:	Surgical Sterilisation in men
Azoospermia	:	Absence of spermatozoa in the ejaculate semen.
Infertility		Inability to conceive or produce children even after the unprotected sexual cohabitation
Ultrasonography	:	Scanning technique which helps to detect fluid disorders during early pregnancy.
Amniocentesis	:	Taking a small sample of amniotic fluid to diagnose for chromosomal abnormalities.
Foetoscope	:	An instrument used to monitor the foetal heart rate.

ACRONYMS

IUD	:	Intra Uterine Devices Devices inserted by medical experts in the uterus as a Contraceptive measure.
MTP	:	Medical termination of pregnancy (voluntary or intentional termination of pregnancy in a Non-surgical way)
STD	:	Sexually transmitted diseases.
AIDS	:	Acquired immunodeficiency syndrome.
HIV	:	Human immunodeficiency virus.
HPV	:	Human papilloma virus
HBV	:	Hepatitis B Virus
IUI	:	Intra Uterine Insemination
IVF	:	In Vitro Fertilization
ZIFT	:	Zygote intra-fallopian transfer
GIFT	:	Gamete Intra-fallopian Transfer
ICSI	:	Intra-cytoplasmic sperm injection
CVS	:	Chorionic Villus Sampling

Evaluation

1. Which of the following is correct regarding HIV, hepatitis B, gonorrhoea and trichomoniasis?

(a) Gonorrhoea is a STD whereas others are not.
(b) Trichomoniasis is a viral disease whereas others are bacterial.
(c) HIV is a pathogen whereas others are diseases.
(d) Hepatitis B is eradicated completely whereas others are not.

[*Ans.* (c) HIV is a pathogen whereas others are diseases]

2. Which one of the following groups includes sexually transmitted diseases caused by bacteria only?

(a) Syphilis, gonorrhoea and candidiasis
(b) Syphilis, chlamydiasis and gonorrhoea
(c) Syphilis, gonorrhoea and trichomoniasis
(d) Syphilis, trichomoniasis and pediculosis

[*Ans.* (b) Syphilis, chlamydiasis and gonorrhoea]

3. Identify the correct statements from the following

(a) Chlamydiasis is a viral disease.
(b) Gonorrhoea is caused by a spirochaete bacterium, *Treponema palladium*.
(c) The incubation period for syphilis is 2 to 14 days in males and 7 to 21 days in females.
(d) Both syphilis and gonorrhoea are easily cured with antibiotics.

[*Ans.* (d) Both syphilis and gonorrhoea are easily cured with antibiotics]

4. A contraceptive pill prevents ovulation by

(a) blocking fallopian tube
(b) inhibiting release of FSH and LH
(c) stimulating release of FSH and LH
(d) causing immediate degeneration of released ovum.

[*Ans.* (b) inhibiting release of FSH and LH]

5. The approach which does not give the defined action of contraceptive is

(a)	Hormonal contraceptive	Prevents entry of sperms, prevent ovulation and fertilization
(b)	Vasectomy	Prevents spermatogenesis
(c)	Barrier method	Prevents fertilization
(d)	Intra uterine device	Increases phagocytosis of sperms, suppresses sperm motility and fertilizing capacity of sperms

[*Ans.* (b) Vasectomy - Prevents spermatogenesis]

6. Read the given statements and select the correct option.

Statement 1: Diaphragms, cervical caps and vaults are made of rubber and are inserted into the female reproductive tract to cover the cervix before coitus.
Statement 2: They are chemical barriers of conception and are reusable.

(a) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
(b) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
(c) Statement 1 is correct but statement 2 is incorrect.
(d) Both statements 1 and 2 are incorrect.

[*Ans.* (c) Statement 1 is correct but statement 2 is incorrect]

7. Match column I with column II and select the correct option from the codes given below.

	Column I		Column II
A.	Copper releasing IUD	(i)	LNG-20
B.	Hormone releasing	(ii)	Lippes loop IUD
C.	Non medicated IUD	(iii)	Saheli
D.	Mini pills	(iv)	Multiload-375

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

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

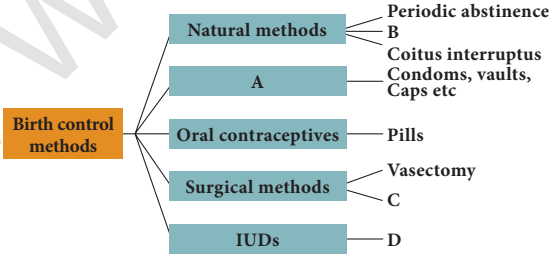
8. Select the incorrect action of hormonal contraceptive pills from the following
(a) Inhibition of spermatogenesis.
(b) Inhibition of ovulation.
(c) Changes in cervical mucus impairing its ability to allow passage and transport of sperms.
(d) Alteration in uterine endometrium to make it unsuitable for implantation.

[*Ans.* (a) Inhibition of spermatogenesis.]

9. What is amniocentesis? Why a statutory ban is imposed on this technique?

Ans. Amniocentesis is a prenatal technique used to detect any chromosomal abnormalities in the foetus and it is being often misused to determine the sex of the foetus. Once the sex of the foetus is known, there may be a chance of female foeticide. Hence, a statutory ban on amniocentesis is imposed.

10. Select the correct term from the bracket and complete the given branching tree



(Barriers, Lactational amenorrhoea, CuT, Tubectomy)

Ans. A – Barrier methods
B – Lactational amenorrhoea
C – Tubectomy
D – CuT

11. Correct the following statements
a) Transfer of an ovum collected from donor into the fallopian tube is called ZIFT.
b) Transfering of an embryo with more than 8 blastomeres into uterus is called GIFT.
c) Multiload 375 is a hormone releasing IUD.

Ans. **(a)** Transfer of an ovum collected from donor into the fallopian tube is called **GIFT (Gamete Intra – fallopian transfer)**
(b) Transferring of an embryo with more than 8 blastomeres into uterus is called **IUT (Intra uterine transfer)**
(c) Multi load 375 is a **copper** releasing IUD.

12. Which method do you suggest the couple to have a baby, if the male partner fails to inseminate the female or due to very low sperm count in the ejaculate?

Ans. Intra Uterine Insemination (IUI)

13. Expand the following a) ZIFT b) ICSI

Ans. **(a)** ZIFT – Zygote intra-fallopian transfer
(b) ICSI – Intra-cytoplasmic sperm injection

14. What are the strategies to be implemented in India to attain total reproductive health?

Ans. These programmes are popularly named as 'Reproductive and Child Health Care (RCH). Major tasks carried out under these programmes are:
(i) Creating awareness and providing medical assistance to build a healthy society.
(ii) Introducing sex education in schools to provide information about adolescence and adolescence related changes.
(iii) Educating couples and those in the marriageable age groups about the available birth control methods and family planning norms.
(iv) Creating awareness about care for pregnant women, post-natal care of mother and child and the importance of breast feeding.

(v) Encouraging and supporting governmental and non-governmental agencies to identify new methods and/or to improve upon the existing methods of birth control.

Health care programmes such as massive child immunization, supply of nutritional food to the pregnant women, Janani Suraksha Yojana, Janani Shishu Suraksha Karyakaram, RMNCH+A approach etc., are taken up at the national level by the Government of India.

15. Differentiate foeticide and infanticide.

Ans.

Foeticide	Infanticide
It refers to 'aborting the foetus in the mother's womb' intentionally.	It is 'killing the child after the birth'.

16. Describe the major STDs and their symptoms.

Ans. STD refers to sexually transmitted diseases. Some of the major sexually transmitted diseases and their symptoms are:

Name of the Disease	Causative agent	Symptom
Bacterial STI		
Gonorrhoea	*Neisseria gonorrhoeae*	Affects the urethra, rectum and throat and in females the cervix also get affected. Pain and pus discharge in the genital tract and burning sensation during urination.
Syphilis	*Treponema palladium*	**Primary stage:** Formation of painless ulcer on the external genitalia. **Secondary stage:** Skin lesions, rashes, swollen joints and fever and hair loss. **Tertiary stage:** Appearance of chronic ulcers on nose, lower legs and palate. Loss of movement, mental disorder, visual impairment, heart problems, gummas (soft non-cancerous growths) etc
Chlamydiasis	*Chlamydia trachomatis*	Trachoma , affects the cells of the columnar epithelium in the urinogenital tract, respiratory tract and conjunctiva.
Viral STI		
Genital herpes	Herpes simplex virus	Sores in and around the vulva, vagina, urethra in female or sores on or around the penis in male. Pain during urination, bleeding between periods. Swelling in the groin nodes.
Genital warts	Human papilloma virus (HPV)	Hard outgrowths (Tumour) on the external genitalia, cervix and perianal region.
Hepatitis-B	Hepatitis B virus (HBV)	Fatigue, jaundice, fever, rash and stomach pain. Liver cirrhosis and liver failure occur in the later stage.
AIDS	Human immunodeficiency virus (HIV)	Enlarged lymph nodes, prolonged fever, prolonged diarrhoea, weight reduction, night sweating.

Name of the Disease	Causative agent	Symptom
Fungal STI		
Candidiasis	*Candida albicans*	Attacks mouth, throat, intestinal tract and vagina. Vaginal itching or soreness, abnormal vaginal discharge and pain during urination.
Protozoan STI		
Trichomoniasis	*Trichomonas vaginalis*	Vaginitis, greenish yellow vaginal discharge, itching and burning sensation, urethritis, epididymitis and prostatitis.

17. How are STDs transmitted?

Ans. **(i)** Normally Sexually transmitted infections (STI) are transmitted from person to person during intimate sexual contact with an infected partner.

(ii) Infections like Hepatitis-B and HIV are transmitted sexually as well as by sharing of infusion needles, surgical instruments, etc with infected people, blood transfusion or from infected mother to baby.

18. Write the preventive measures of STDs.

Ans. **Prevention of STDs (Sexually Transmitted diseases)**

(i) Avoid sex with unknown partner/ multiple partners

(ii) use condoms

(iii) In case of doubt, consult a doctor for diagnosis and get complete treatment.

19. The procedure of GIFT involves the transfer of female gametes into the fallopian tube, can gametes be transferred to the uterus to achieve the same result? Explain.

Ans. **(i)** Fertilization of sperm and egg takes place in the fallopian tube. The fertilized egg (Zygote) slowly move down and reaches the uterus as a ball of cells for implantation.

(ii) Therefore in most cases related to the Assisted Reproductive Technology, the zygote is transferred to the uterus.

(iii) In a method called as Intra—uterine insemination male gametes are introduced in the uterus.

This is a procedure to treat infertile men with low sperm count. The semen is collected either from the husband or from a healthy donor and is introduced into the uterus through the vagina by a catheter after stimulating the ovaries to produce more ova.

The sperms swim towards the fallopian tubes to fertilize the egg, resulting in normal pregnancy.

20. Amniocentesis, the foetal sex determination test, is banned in our country, Is it necessary? comment.

Ans. **(i)** Amniocentesis is a prenatal technique used to detect any chromosomal abnormalities in the foetus.

(ii) This can be done to check if the baby is normal or has any kind of genetic defect.

(iii) If the baby shows genetic abnormalities, abortion of the foetus may be required, Therefore amniocentesis can help to confirm the healthy status of the foetus. But using the technique for sex determination must be banned, because it can lead to female foeticide.

(iv) Now a days other tests are also available to test the chromosomal abnormalities of the foetus.

21. Open Book Assessment

'Healthy reproduction, legally checked birth control measures and proper family planning programmes are essential for the survival of mankind' Justify.

Ans. **Open book Assessment**

The teacher may request students to make use of the text and find answers for the same in the class.

Additional Questions

Choose the Correct Answer — 1 Mark

I. Choose the Correct options for the below Questions

1. The family planning programme was initiated by India in _____
(a) 1953 (b) 1972
(c) 1963 (d) 1951
[*Ans.* (d) 1951]

2. In the year_____ india is expected to become the largest country in population size _____
(a) 2021 (b) 2025
(c) 2022 (d) 2030
[*Ans.* (c) 2022]

3. Sperm remains active for _____ hours in the female reproductive tract
(a) 60 (b) 70 (c) 72 (d) 78
[*Ans.* (c) 72]

4. Saheli is an example for _____ method
(a) Mechanical barrier (b) Chemical barrier
(c) Hormonal barrier
(d) Intra uterine devices
[*Ans.* (c) Hormonal barrier]

5. Formation of chronic ulcer is a symptom of __
(a) Genital herpes (b) Syphilis
(c) Gonorrhoea (d) AIDS
[*Ans.* (b) Syphilis]

6. Fatigue, Jaundice, stomach pain are the symptoms of_____
(a) Genital warts (b) AIDS
(c) Chlamydiasis (d) Hepatitis–B
[*Ans.* (d) Hepatitis–B]

7. The incubation period for _____ varies between 1–8 months.
(a) HPV (b) HIV
(c) HBV (d) candida
[*Ans.* (a) HPV]

8. The incubation period for _____ can be more than 10 years.
(a) HPV (b) HBV
(c) Treponema (d) HIV
[*Ans.* (d) HIV]

9. PAP smear can help to detect
(a) Jaundice (b) Cancer
(c) AIDS (d) Hepatitis B
[*Ans.* (b) Cancer]

10. _____ vaccination of girls between 9–13 years can prevent cervical cancer.
(a) HIV (b) HPV
(c) MMR (d) HBV
[*Ans.* (b) HPV]

11. Mayer – Rokitansky syndrome is a condition in which
(a) Ova are not produced
(b) Ovaries are not formed
(c) Uterus is not functioning
(d) Fallopian tube is ruptured
[*Ans.* (c) Uterus is not functioning]

12. Test tube baby is got by _____ technique
(a) IUI (b) CVS
(c) ICSI (d) IVF
[*Ans.* (d) IVF]

13. Cryopreservation of embryos are done when _____
(a) When eggs are not available
(b) Sperm count is less
(c) More embryos are available than the required
(d) there is abnormality in the embryo
[*Ans.* (c) More embryos are available than the required]

14. One sperm is directly injected into cytoplasm of the egg in _____technique
(a) ICSI (b) GIFT
(c) IUT (d) TCSE
[*Ans.* (a) ICSI]

15. _____ involves taking a sample of placental tissues to test for chromosomal abnormalities
(a) CVS (b) ICSI
(c) TESE (d) IVF
[*Ans.* (a) CVS]

16. _____ is needed for normal functioning of reproductive structures
(a) Vitamin A (b) Vitamin E
(c) Vitamin B (d) Vitamin C
[*Ans.* (b)Vitamin E

17. _____ is observed as world population day
(a) 11th June (b) 11th April
(c) 11th July (d) 11th May
[*Ans.* (c) 11th July]

18. International diseases refer to _____
(a) Syphilis and AIDS
(b) AIDS and Gonorrhoea
(c) AIDS and Hepatitis B
(d) Syphilis and Gonorrhoea
[*Ans.* (d) Syphilis and Gonorrhoea]

19. Most of the intrauterine transfer of embryo is done at_____ stage
(a) 8 celled (b) 16 celled
(c) 32 celled (d) 4 celled
[*Ans.* (a) 8 celled]

20. _____ is an epidemic disease.
(a) HPV (b) HIV
(c) Cervical cancer (d) Jaundice
[*Ans.* (b) HIV]

21. In India, Family Planning Programme was introduced in
(a) 1941 (b) 1951
(c) 1961 (d) 1971
[*Ans.* (b) 1951]

22. Expansion of the RCH is _____ .
(a) Reproduction and Children Health Programme.
(b) Reproductive and Child's Health Committee.
(c) Reproduction and Critical Health Care.
(d) Reproductive and Child Health Care.
[*Ans.*(c) Reproductive and Child Health Care]

23. One of the following prevents sperm from heading off to penis as the discharge has no sperms in it.
(a) Tubectomy (b) LNG – 20
(c) Vasectomy (d) Cu T 380 Ag
[*Ans.* (c) Vasectomy]

24. This is not the Major task of RCH.
(a) Vaccinating the mother and child for infectious diseases
(b) Introducing six education in Schools
(c) Educating couples about the available with control
(d) Creating awareness about care for pregnant Women
[*Ans.* (a) Vaccinating the mother and child for infectious diseases]

25. All the following aims at creating a safe and secure environment for both females and males. Except.
(a) Sexual Harassment at work place Act.
(b) POCSO Act
(c) Recommendation of Justice Verma Committee, 2013.
(d) PCPNDT [*Ans.* (d) PCPNDT]

26. This is an ideal contraceptive for females who want to delay pregnancy.
(a) Oral contraceptives
(b) IUDs
(c) Diaphragms, cervical caps
(d) Vaults [*Ans.* (b) IUDs]

27. At which stage the embryo is transferred into the uterus.
(a) 4 celled stage (b) 8 celled stage
(c) 12 celled stage (d) 16 celled stage
[*Ans.* (b) 8 celled stage]

28. This technique is used to diagnose the chromosomal abnormities.
(a) Assisted Reproductive Technology (ART)
(b) Micro Testicular Sperm Extraction
(c) Amniocentesis
(d) GIFT
[*Ans.* (c) Amniocentesis]

29. Identify the bacterial STI
1. Affects the urethra, vectron and throat
2. In females cervix is affected.
3. Pain and pus discharge in the genital tract.
4. Burning sensation during urination.

(a) Gonorrhoea. (b) Syphilis
(c) Chlanydiasis. (d) Lympho
[*Ans.* (a) Gonorrhoea]

30. **An abnormal foetal heart beat rate or pattern indicates the foetus is not getting enough**
(a) Nutrients (b) Oxygen
(c) Blood. (d) Signals.
[Ans. (b) Oxygen]

31. **Fatigue, jaundice, fever, rash, stomach pain, liver Cirrhosis and liver failure – are the symptoms of**
(a) Chalmydiasis
(b) Lynphogvanuloma Veneveum.
(c) Hepatitis
(d) Syphilis **[Ans. (c) Hepatitis]**

32. **In this Assisted Reproductive Technology (ART), the sperms and egg are allowed to united outside the body and then transformed into the woman's uterus.**
(a) Intra – uterine insemination (IUI)
(b) In vitro Fertilization (IVF)
(c) Zygote Intra – Fallopian Transfer (ZIFT)
(d) Intra uterine transfer (IUT).
[Ans. (b) In vitro Fertilization (IVF)]

33. **Cervical Cancer can be diagnosed by __X__ combined with __Y__ test, but the stage of Cancer is determined by __Z__**

	X	Y	Z
(a)	HPV	PAP Smear	PET Scan
(b)	PAP Smear	HPV	PET Scan
(c)	MRI	CT Scan	MRI
(d)	PET Scan	X – Ray	CT Scan

[Ans. (b) PAP Smear - HPV - PET Scan]

II. Choose the Correct Options for the Below Fill in the Blanks

1. **Prevention of children from sexual offences is covered under_____ act**
(a) PCPNDT (b) patent act
(c) ART (d) POCSO
[Ans. (d) POCSO]

2. **_____ can be diagnosed by PAP smear test**
(a) Cervical cancer (b) Bone cancer
(c) Blood cancer (d) Intestinal cancer
[Ans. (a) Cervical cancer]

3. **_____ is a prenatal technique to detect chromosomal abnormalities in the foetus**
(a) Amniocentesis
(b) PSA test (Prostate Specific Antigens Test)
(c) PAP test
(d) PT test (Prothrombin Time Test)
[Ans. (a) Amniocentesis]

4. **The problem of overpopulation can be overcome by _____**
(a) awareness program (b) free education
(c) Birth control (d) meals scheme
[Ans. (c) Birth control]

5. **Foaming tablets and jellies are _____ barriers for birth control**
(a) mechanical (b) Chemical
(c) hormonal (d) natural
[Ans. (b) Chemical]

6. **Oral contraceptive pills contain synthetic _____ and _____ hormones**
(a) androgen and testosterone
(b) Androgen and Oxytocin
(c) relaxin and inhibin
(d) Progesterone and estrogen
[Ans. (d) Progesterone and estrogen]

7. **_____ is an example of a contraceptive pill.**
(a) Alesse (b) Ortho Tri-cyclen
(c) Saheli (d) Eryosterol
[Ans. (c) Saheli]

8. **IUD's increase _____ of the sperm within the uterus**
(a) Endocytosis (b) Pinocytosis
(c) Phagocytosis (d) Exocytosis
[Ans. (c) Phagocytosis]

9. **The _____ method of contraception has a success rate of 95 – 99% in India.**
(a) IUDs Intra-uterine devices
(b) Hormonal
(c) Chemical (d) mechanical
[Ans. (a) IUDs Intrauterine devices]

10. **Diseases like _____ are transmitted sexually and by sharing of needless**
(a) gonorrhoea (b) genital herpes
(c) AIDS/Hepatitis – B (d) candidiasis
[Ans. (c) AIDS/Hepatitis - B]

11. _____ is a sexually transmitted diseases caused by protozoan
(a) Trichomoniasis (b) Genital warts
(c) Syphilis (d) Candidiasis
[*Ans.* (a) Trichomoniasis]

12. _____ is a sexually transmitted disease caused by a fungus
(a) Chlamydiasis (b) Candidiasis
(c) Genital herps (d) Syphilis
[*Ans.* (b) Candidiasis]

13. _____ is a cause of infertility in women
(a) varicocoele
(b) Endometriosis/Uterine fibroids
(c) well developed ovaries
(d) hormonal balance
[*Ans.* (b) Endometriosis/Uterine fibroids]

14. _____ is a procedure to treat infertile man with low sperm count
(a) Intra-uterine insemination
(b) In vitro fertilization
(c) Intra-uterine transfer
(d) Zygote intra-fallopian transfer
[*Ans.* (a) Intra-uterine insemination]

15. _____ is a method for preservation of embryos
(a) Mechanical preservation
(b) Chemical preservation
(c) Cryopreservation
(d) Heat preservation
[*Ans.* (c) Cryopreservation]

16. _____ is a condition in which there is absence of spermatozoa in the ejaculate serum
(a) teratozoospermia
(b) Asthenozoospermia
(c) Oligozoospermia
(d) *Azoospermia* [*Ans.* (d) *Azoospermia*]

17. Coitus can be avoided on the 14th day of the menstrual cycle to prevent fertilization, because _____ takes place on that day.
(a) Lactation.
(b) Ovulation.
(c) Sperms are more active.
(d) Uterus is ready for implantation.
[*Ans.* (b) Ovulation]

18. _____ is a method used to detect foetal diseases during early pregnancy
(a) CT scanning (b) MRI scanning
(c) Ultrasound scanning (d) PET scanning
[*Ans.* (c) Ultrasound scanning]

19. Usage of _____ greatly reduces the risk of STI.
(a) IUDS. (b) Latex Condoms.
(c) Saheli (d) Lippes loop
[*Ans.* (b) Latex Condoms]

III. Identify the correct Statements

1.
(i) HPV causes tumours
(ii) Syphilis is transmitted sexually by sharing of needles
(iii) The statutory marriageable age for males is 18 years
(iv) Surgical sterilization methods block the transfer of gametes
(a) i, iii and iv (b) i and iv
(c) iii and iv (d) ii only
[*Ans.*(b) i and iv]

2.
(i) Saheli contains synthetic testosterone and estrogen
(ii) Non medicated IUDs are made of copper
(iii) Lactational amenorrhoea cause infertility
(iv) Embryo transfer techniques helps to treat many causes of infertility
(a) i and iii (b) ii and iii
(c) iv only (d) i, iii, and iv
[*Ans.*(c) iv only]

IV. Identify the Wrong Pair

1.
(i) Chemotherapy – Cervical cancer
(ii) IVF – Egg retrival
(iii) Contraceptive – Infertility
(iv) Cryopreservation – Avoid ovarian stimulation
(a) iii only (b) ii, and iv
(c) iv (d) i and iv only
[*Ans.*(a) iii only]

2. (i) Doppler device – Foetal heart
(ii) NACO – Family planning
(iii) 4 – D ultrasound – Early pregnancy
(iv) Herpes simplex – Enlarged lymph nodes

(a) i and iv (b) ii, and iv
(c) i and iii (d) iii and iv

[*Ans.*(b) ii, and iv]

3. (i) Non-medicated IUD – Lippes loop
(ii) Saheli – Plastic loop
(iii) Hormone releasing IUD – Progestasert
(iv) Copper releasing IUD – Multi load 375

(a) i and iv (b) ii
(c) i and iii (d) iii and iv

[*Ans.*(b) ii]

V. Match the following

1.

1.	GIFT	(a) Fallopian tube
2.	ICSI	(b) placental tissue
3.	CVS	(c) uterus
4.	ZIFT	(d) injection of sperm

(A) 1 – b 2 – a 3 – c 4 – d
(B) 1 – a 2 – b 3 – d 4 – c
(C) 1 – a 2 – d 3 – b 4 – c
(D) 1 – c 2 – b 3 – c 4 – d

[*Ans.* (C) 1-a 2-d 3-b 4-c]

2.

1.	Syphilis	(a) Trachoma
2.	Gonorrhoea	(b) Greenish yellow discharge
3.	Chlamydiasis	(c) Ulcer
4.	Trichomoniasis	(d) Pain and pus

(A) 1 – d 2 – a 3 – c 4 – b
(B) 1 – c 2 – a 3 – d 4 – b
(C) 1 – b 2 – a 3 – d 4 – c
(D) 1 – c 2 – d 3 – a 4 – b

[*Ans.* (D) 1-c 2-d 3-a 4-b]

3.

1.	IUD	A. LNG – 20
2.	Natural method	B. Meeting of gametes
3.	IUS	C. Phagocytosis
4.	Diaphragm	D. Rhythm

(A) 1 – b 2 – c 3 – a 4 – d
(B) 1 – c 2 – d 3 – a 4 – b
(C) 1 – c 2 – d 3 – b 4 – c
(D) 1 – a 2 – c 3 – b 4 – d

[*Ans.* (B) 1-c 2-d 3-a 4-b]

VI. Identify the correct assertion and reason

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) A and R correct, R is the correct explanation of A
(b) A and R right but R is not the correct explanation of A
(c) A is correct R is false
(d) Both A & R are false

1. **Assertion :** STD can be prevented by Monogamy
Reason : TNHSP, a unit of Health and family welfare development of Government of Tamil Nadu does free screening for cervical and breast cancer.

[*Ans.* (b) A and R correct, R is not the correct explanation of A]

2. **Assertion :** MTP during the second trimester is risky for the parent & foetus
Reason : It must be performed by trained medical personnel

[*Ans.* (a) A and R correct, R is the correct explanation of A]

3. **Assertion :** Oral contraceptives are not recommended for birth control
Reason : Surgical sterilisation is the best birth control method for all age groups

[*Ans.* (d) Both A & B are false]

4. **Assertion :** Vitamin E helps in the normal functioning of reproductive structures in man.
Reason : Vitamin E is known as anti sterility vitamin.

[*Ans.* (a) Both A and R correct. R is the explanation to A]

5. **Assertion :** Condomes safeguards the user from AIDS and STDs.
Reason : Condoms are made of polyunthane, latex and lambskin.

[*Ans.* (a) A and R correct, R is the correct explanation of A]

orders@surabooks.com PH: 9600175757 / 8124201000 / 8124301000

VII. Choose the odd man out

1. (a) Saheli (b) CuT – 380
(c) LNG – 20 (d) GnRH
[Ans. GnRH]
Reason: It is a hormone, whereas the others are example of contraceptives.

2. (a) IUD (b) ICSI
(c) Vasectomy (d) IUS
[Ans. ICSI]
Reason: It is a technique to achieve pregnancy whereas the others are birth control methods.

3. (a) Amniocentesis (b) CVS
(c) Ultrasound scanning (d) Foetoscope
[Ans. Foetoscope]
Reason: It is an instrument to monitor the foetal heart beat whereas the others are techniques to detect abnormalities in the foetus

4. (a) Syphilis (b) Candidiasis
(c) chlamydiasis (d) Gonorrhoea
[Ans. Candidiasis]
Reason: It is an sexually transmitted infection caused by fungus whereas the others are sexually transmitted infections caused by bacteria.

5. (a) Candidiasis (b) Hepatitis B
(c) Genital herpes (d) Genital warts
[Ans. (a) Candidiasis is a Fungal STI (disease)]

6. (a) Cervical cancer (b) Trichomoniasis
(c) Genital wants (d) Cervical dysplasia
[Ans. (b) Trichonomiasis is a proto zoan SIT (disease)]

Answer in one word*

1. Government of India legalized MTP in _____.
[Ans. 1971]
2. Saheli was developed by Central drug research institute located at _____ [Ans. Lucknow]
3. Cervical cancer can be prevented with _____
[Ans. Vaccination]
4. Natural AIDS control organization was established in_____ [Ans. 1992]
5. 1st December is observed as _____
[Ans. World AIDS day]
6. Surgical sterilisation in women is called _____ [Ans. Tubectomy]
7. Cervical cancer is caused by _____
[Ans. Human papilloma virus HPV]
8. In Mayer Rokitansky syndrome, female _____
[Ans. Do not have functional uterus]
9. _____ is a hormone releasing IUD
[Ans. Progestasert/LNG – 20]
10. _____ is a copper releasing IUD.
[Ans. NovaT, Multi load 375
11. Surgical sterilisation in male is called _____
[Ans. Vasectomy]
12. Medical termination of pregnancy is safe upto _____ weeks [Ans. 12]
13. The contraceptive pill saheli contains a non – steroidal preparation called_____
[Ans. Centchroman]
14. Foetal hear beat during pregnancy is monitored by use of _____ [Ans. Foetoscope]
15. There is no incubation period for the cavsal organism in _____ [Ans. Candidiasis]

* Only for quick revision not in pattern

Give Reasons

1. **Hormone – releasing IUDs are called IVS (Intrauterine systems)**
Ans. They increase the viscosity of the cervical mucus and thereby prevent sperms from entering the cervix.

2. **Surgical sterilisation method can prevent pregnancy permanently**
Ans. Surgical sterilisation methods are the permanent contraception methods advised for male and female partners to prevent any more pregnancies. It blocks the transport of the gametes and prevents conception.

3. **Modification in life style can prevent cervical cancer**
Ans. Modification in lifestyle can also help in preventing cervical cancer. Healthy diet, avoiding tobacco usage, preventing early marriages, practicing monogamy and regular exercise minimize the risk of cervical cancer.

Very Short Answers 2 Marks

1. What is PCPNDT Act?

Ans. Government of India has taken various steps like PCPNDT Act (Preconception and Prenatal diagnostic technique act-1994) enacted to ban the identification of sex and to prevent the use of prenatal diagnostic techniques for selective abortion.

2. Define birth control.

Ans. The voluntary use of contraceptive procedures to prevent fertilization or prevent implantation of a fertilized egg in the uterus is termed as birth control.

3. What are the characteristics of an ideal contraceptive?

Ans. An ideal contraceptive should be user friendly, easily available, with least side effects and should not interfere with sexual drive.

4. What is the purpose of barrier method of contraception?

Ans. In these methods, the ovum and sperm are prevented from meeting so that fertilization does not occur.

5. What is Saheli?

Ans. Saheli, is a contraceptive pill devised by Central Drug Research Institute (CDRI) in Lucknow, India. It contains a non-steroidal preparation called centchroman.

6. What is the role of IUDs?

Ans. IUD - Intra-Uterine Device. They increase of phagocytosis of sperm within the uterus and prevent meeting of gametes there by acting as birth control measure.

7. Define Tubectomy and Vascetomy.

Ans. *(i)* Tubectomy is the surgical sterilisation method in women.

(ii) Vasectomy is the surgical sterilisation method in male.

8. What does MTP stand for?

Ans. *(i)* MTP stands for medical termination of pregnancy

(ii) Medical method of abortion is a voluntary or intentional termination of pregnancy in a non-surgical or non-invasive way.

9. Name two sexually transmitted infections and their casual agent.

Ans.

Disease	Casual agent
Hepatitis-B	Hepatitis B virus
AIDS	HIV(Human Immunodeficiency Virus)

10. Mention two sexually transmitted diseases caused by bacteria.

Ans. Syphilis and Gonorrhoea

11. Mention two sexually transmitted diseases caused by virus.

Ans. AIDS and Genital Herpes.

12. What is cervical dysplasia?

Ans. Cervical cancer is caused by a sexually transmitted virus called Human Papilloma virus (HPV). HPV may cause abnormal growth of cervical cells or cervical dysplasia.

13. What is IUT?

Ans. IUT - Intra Uterine Transfer

(i) Embryo with more than 8 blastomeres is inserted into uterus to complete its further development.

(ii) It is a method to achieve pregnancy by Assisted Reproductive technology.

14. Define Infertility.

Ans. Inability to conceive or produce children even after unprotected sexual cohabitation is called infertility.

15. Define Surrogacy.

Ans. Surrogacy is a method of assisted reproduction or agreement whereby a woman agrees to carry a pregnancy for another person, who will become the newborn child's parent after birth.

16. Why is Ultrasonography performed during pregnancy?

Ans. Ultrasonography is usually performed in the first trimester for dating, determination of the number of foetuses, and for assessment of early pregnancy complications.

17. What is CVS?

Ans. CVS - Chorionic Villus Sampling. CVS is a prenatal test that involves taking a sample of the placental tissue to test for chromosomal abnormalities.

18. What is a Foetoscope?

Ans. *(i)* Foetoscope is used to monitor the foetal heart rate and other functions during late pregnancy and labour. The average foetal heart rate is between 120 and 160 beats per minute.

(ii) An abnormal foetal heart rate or pattern may mean that the foetus is not getting enough oxygen and it indicates other problems.

19. What is Mayer-Rokitansky syndrome?

Ans. All women are born with ovaries, but some do not have functional uterus. This condition is called Mayer-Rokitansky syndrome.

Short Answers — 3 Marks

1. What is lactational amenorrhoea?

Ans. Menstrual cycles resume as early as 6 to 8 weeks from parturition. However, the reappearance of normal ovarian cycles may be delayed for six months during breastfeeding. This delay in ovarian cycles is called lactational amenorrhoea. It serves as a natural but an unreliable form of birth control.

2. Mention the type of IUDs with example.

Ans. *(i)* Copper releasing IUD - Multiload 375 CuT 380.

(ii) Hormone – releasing IUD - LNG-20.

(iii) Non-medicated IUD - Lippes loop.

3. Mention any 3 causes for infertility.

Ans. *(i)* Low body fat or anorexia in women. i.e. a psychiatric eating disorder characterised by the fear of gaining weight.

(ii) Under developed ovaries or testes.

(iii) Female may develop antibodies against her partner's sperm.

4. What is ZIFT?

Ans. ZIFT - Zygote Intra-Fallopian Transfer. As in IVF, the zygote upto 8 blastomere stage is transferred to the fallopian tube by laparoscopy. The zygote continues its natural divisions and migrates towards the uterus where it gets implanted.

5. What is Cryopreservation?

Ans. Cryopreservation (or freezing) of embryos is often used when there are more embryos than needed for a single IVF transfer. Embryo cryopreservation can provide an additional opportunity for pregnancy, through a Frozen embryo transfer (FET), without undergoing another ovarian stimulation and retrieval.

6. What is GIFT?

Ans. GIFT - Gamete Intra-Fallopian Transfer

(i) Transfer of an ovum collected from a donor into the fallopian tube. In this the eggs are collected from the ovaries and placed with the sperms in one of the fallopian tubes.

(ii) The zygote travels toward the uterus and gets implanted in the inner lining of the uterus.

7. What is embryo transfer technique?

Ans. The transfer of an embryo with more than 8 blastomeres stage into uterus is called embryo transfer technique.

8. What are the causes of infertility in human beings?

Ans. Inability to conceive or produce children even after unprotected sexual cohabitation is called infertility.

Causes of infertility:

(i) Pelvic inflammatory disease (PID), uterine fibroids and endometriosis are the most common causes of infertility in women.

(ii) Low body fat or anorexia in women. i.e. a psychiatric eating disorder characterised by the fear of gaining weight.

(iii) Under developed ovaries or testes.

9. What is micro-testicular sperm extraction (TESE)?

Ans. Microsurgical sperm retrieval from the testicle involves a dilation of the microscope, the seminiferous tubules under the microscope and small amount of testicular tissue in areas of active sperm production are removed. This is improved for sperm yield compared to traditional biopsy techniques.

10. How will you detect the foetal disorders, during the early stages of pregnancy?

Ans. The techniques used to detect the foetal disorders during the early stages of pregnancy are:

(i) Ultrasound scanning

(ii) Amniocentesis

(iii) Chorionic villus sampling (CVS)

(iv) Foetoscope

Long Answers — 5 Marks

1. Write notes on any two techniques in Assisted Reproductive Technology (ART).

Ans. A collection of procedures which includes the handling of gametes and / or embryos outside the body to achieve a pregnancy is known as Assisted Reproductive Technology. ART includes

(i) **Intra-uterine insemination (IUI):** This is a procedure to treat infertile men with low sperm count. The semen is collected either from the husband or from a healthy donor and is introduced into the uterus through the vagina by a catheter after stimulating the ovaries to produce more ova. The sperms swim towards the fallopian tubes to fertilize the egg, resulting in normal pregnancy.

(ii) **In vitro fertilization (IVF):** In this technique, sperm and eggs are allowed to unite outside the body in a laboratory. One or more fertilized eggs may be transferred into the woman's uterus, where they may implant in the uterine lining and develop. Excess embryos may be cryopreserved (frozen) for future use. IVF is used to treat many causes of infertility.

(iii) The basic steps in an IVF treatment cycle are ovarian stimulation, egg retrieval, fertilization, embryo culture and embryo transfer. Egg retrieval is done by minor surgery under general anesthesia, using ultrasound guide after 34 to 37 hours of hCG (human chorionic gonadotropin) injection. The eggs are prepared and stripped from the surrounding cells. At the same time, sperm preparation is done using a special media. After preparing the sperms, the eggs are brought together. 10,000-1,00,000 motile sperms are needed for each egg. Then the zygote is allowed to divide to form 8 celled blastomere and then transferred into the uterus for a successful pregnancy. The transfer of an embryo with more than 8 blastomeres stage into uterus is called embryo transfer technique.

2. Explain about breast self Examination and Early diagnosis of Cancer.

Ans. Breast self examination and early diagnosis of cancer

(i) Breast is divided into 4 quadrants and the center (Nipple) which is the 5th quadrant.

(ii) Each quadrant of the breast is felt for lumps using the palm of the opposite hand.

(iii) The examination is done in both lying down and standing positions, monthly once after the 1st week of menstrual cycle.

This way if there are lumps or any deviation of the nipple to one side or any blood discharge from the nipple we can identify cancer at an early stage. Mammograms are done for women above the age of 40 years and for young girls and women below 40 years. Ultrasound of the breast aids in early diagnosis.

3. Write a note on cervial cancer.

Ans. **Cervical cancer:** Cervical cancer is caused by a sexually transmitted virus called Human Papilloma virus (HPV). HPV may cause abnormal growth of cervical cells or cervical dysplasia.

The most common symptoms and signs of cervical cancer are pelvic pain, increased vaginal discharge and abnormal vaginal bleeding. The risk factors for cervical cancer include

(i) Having multiple sexual partners

(ii) Prolonged use of contraceptive pills

Cervical cancer can be diagnosed by a Papanicolaou smear (PAP smear) combined with an HPV test. X-Ray, CT scan, MRI and a PET scan may also be used to determine the stage of cancer. The treatment options for cervical cancer include radiation therapy, surgery and chemotherapy.

Modern screening techniques can detect precancerous changes in the cervix. Therefore screening is recommended for women above 30 years once in a year. Cervical cancer can be prevented with vaccination. Primary prevention begins with HPV vaccination of girls aged 9 – 13 years, before they become sexually active. Modification in lifestyle can also help in preventing cervical cancer. Healthy diet, avoiding tobacco usage, preventing early marriages, practicing monogamy and regular exercise minimize the risk of cervical cancer.

4. What is infertility and write its causes.

Ans. Inability to conceive or produce children even after unprotected sexual cohabitation is called infertility. That is, the inability of a man to produce sufficient numbers or quality of sperm to impregnate a woman or inability of a woman to become pregnant or maintain a pregnancy.

The causes for infertility are tumours formed in the pituitary or reproductive organs, inherited mutations of genes responsible for the biosynthesis of sex hormones, malformation of the cervix or fallopian tubes and inadequate nutrition before adulthood. Long-term stress damages many aspects of health especially the menstrual cycle. Ingestion of toxins (heavy metal cadmium), heavy use of alcohol, tobacco and marijuana, injuries to the gonads and aging also cause infertility.

Other causes of infertility:

(i) Pelvic inflammatory disease (PID), uterine fibroids and endometriosis are the most common causes of infertility in women.

(ii) Low body fat or anorexia in women. i.e. a psychiatric eating disorder characterised by the fear of gaining weight.

(iii) Undescended testes and swollen veins (varicocoele) in scrotum. Tight clothing in men may raise the temperature in the scrotum and affect sperm production.

(iv) Under developed ovaries or testes.

(v) Female may develop antibodies against her partner's sperm.

(vi) Males may develop an autoimmune response to their own sperm.

5. What is ART? Explain any two fo ART.

Ans. A collection of procedures, which includes the handling of gametes and/or embryos outside the body to achieve a pregnancy, is known as **Assisted Reproductive Technology**. It increases the chance of pregnancy in infertile couples. ART includes intra-uterine insemination (IUI), in vitro fertilization, (IVF) Embryo transfer (ET), Zygote intra-fallopian transfer (ZIFT), Gamete intrafallopian transfer (GIFT), Intra-cytoplasmic sperm injection (ICSI), Preimplantation genetic diagnosis, oocyte and sperm donation and surrogacy.

(i) **Intra-cytoplasmic sperm injection (ICSI):** In this method only one sperm is injected into the focal point of the egg to fertilize. The sperm is carefully injected into the cytoplasm of the egg. Fertilization occurs in 75 - 85% of eggs injected with the sperms. The zygote is allowed to divide to form an 8 celled blastomere and then transferred to the uterus to develop a protective pregnancy.

(ii) **Surrogacy:** Surrogacy is a method of assisted reproduction or agreement whereby a woman agrees to carry a pregnancy for another person, who will become the newborn child's parent after birth. Through in vitro fertilization (IVF), embryos are created in a lab and are transferred into the surrogate mother's uterus.

Unit Test

[Time : 1 hr] [Marks: 25]

I. Choose the Correct Answer. 10 × 1 = 10

1. **Which one of the following groups includes sexually transmitted diseases caused by bacteria only?**
(a) Syphilis, gonorrhoea and candidiasis
(b) Syphilis, chlamydiasis and gonorrhoea
(c) Syphilis, gonorrhoea and trichomoniasis
(d) Syphilis, trichomoniasis and pediculosis

2. **International diseases refer to _____**
(a) Syphilis and AIDS
(b) AIDS and Gonorrhoea
(c) AIDS and Hepatitis B
(d) Syphilis and Gonorrhoea

3. **Most of the intrauterine transfer of embryo is done at_____ stage**
(a) 8 celled (b) 16 celled
(c) 32 celled (d) 4 celled

4. **Sperm remains active for _____ hours in the female reproductive tract**
(a) 60 (b) 70 (c) 72 (d) 78

5. **Usage of _____ greatly reduces the risk of STI.**
(a) IUDS. (b) Latex Condoms.
(c) Saheli (d) Lippes loop

6. **One sperm is directly injected into cytoplasm of the egg in _____technique**
(a) ICSI (b) GIFT
(c) IUT (d) TCSE

7. **Read the given statements and select the correct option.**
Statement 1: Diaphragms, cervical caps and vaults are made of rubber and are inserted into the female reproductive tract to cover the cervix before coitus.
Statement 2: They are chemical barriers of conception and are reusable.
(a) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
(b) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
(c) Statement 1 is correct but statement 2 is incorrect.
(d) Both statements 1 and 2 are incorrect.

8. **Identify the Wrong Statements:**
(i) Chemotherapy – cervical cancer
(ii) IVF – Egg retrival
(iii) Contraceptive – Infertility
(iv) Cryopreservation – Avoid ovarian stimulation
(a) iii only (b) ii, and iv
(c) iv (d) i and iv only
[Ans.(a) iii only]

9. **The _____ method of contraception has a success rate of 95 – 99% in india.**
(a) IUDs Intrauterine devices
(b) Hormonal
(c) Chemical
(d) mechanical

10. **A contraceptive pill prevents ovulation by**
(a) blocking fallopian tube
(b) inhibiting release of FSH and LH
(c) stimulating release of FSH and LH
(d) causing immediate degeneration of released ovum.

II. Very Short Answer 2 × 2 = 4

11. What is CVS?
12. What is the role of IUDs?

III. Short Answer 2 × 3 = 6

13. How are STDs transmitted?
14. What is GIFT?

IV. Long Answer 1 × 5 = 5

15. What are the strategies to be implemented in India to attain total reproductive health?

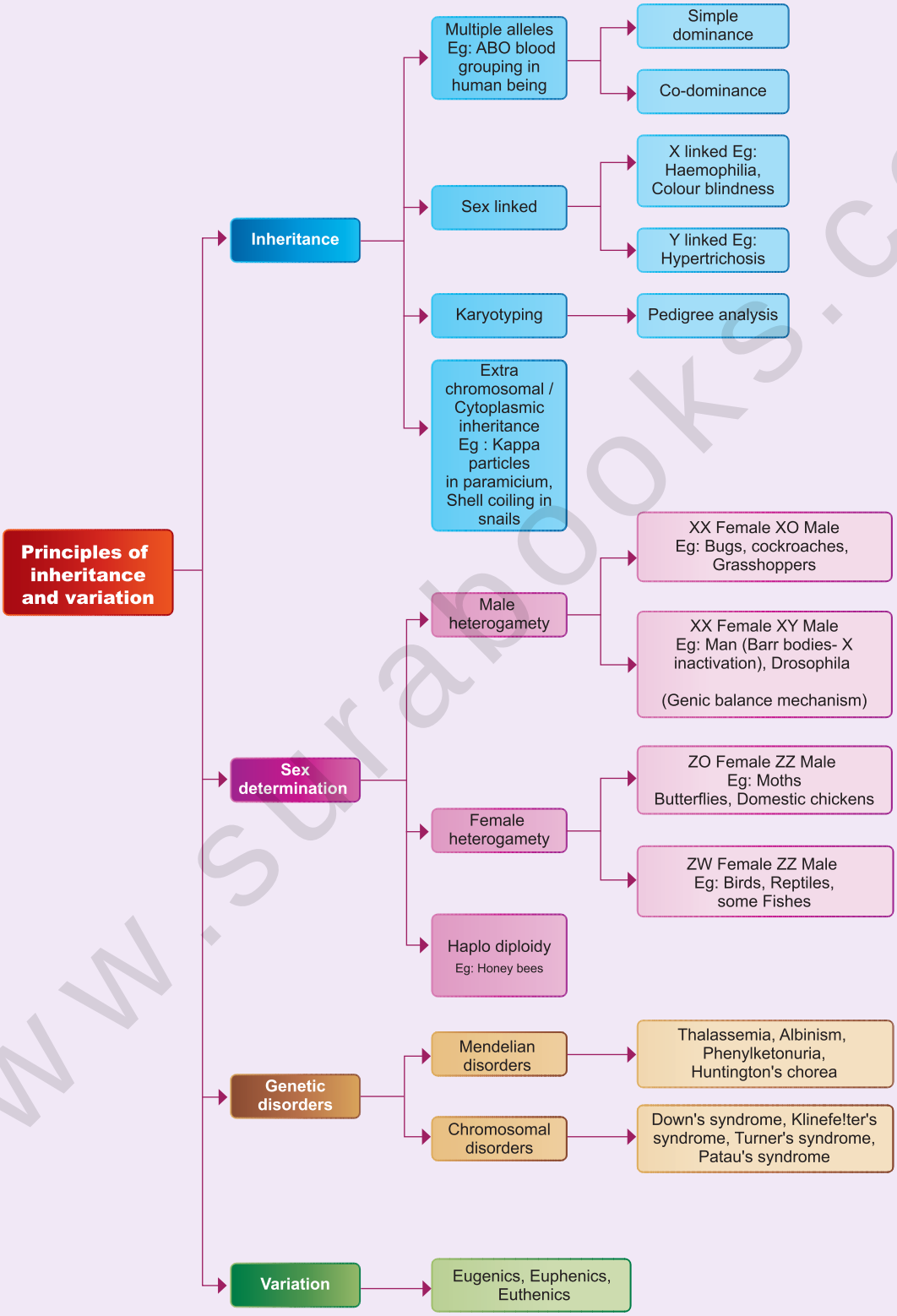
UNIT II

Chapter 4

PRINCIPLES OF INHERITANCE AND VARIATION

CHAPTER SNAPSHOT

Concept Map



MUST KNOW DEFINITIONS

Multiple allelism	:	When three or more alleles of a gene that control a particular trait occupy the same locus on the homologous chromosome of an organism, they are called multiple alleles and their inheritance is called **multiple allelism.**
Genetics	:	Genetics is a branch of biology that deals with the study of heredity and variations.
Rh factor	:	An antigen discovered in surface of RBC of Rhesus monkey and later in human beings.
Erythroblastosis foetalis	:	Haemolysis of Foetal RBC's due to incompatibility of Rh factor between maternal basis and foetal blood.
Heterogametic	:	organism produces two types of gametes.
Homogametic	:	organism produces similar type of gametes.
Nucleosome	:	In eukaryotes, chromatin is formed by a series of repeating units called Nucleosome.
Sex – switch gene	:	A gene located on X chromosome of *Drosophila* having two states of activity.
Gynandromorph	:	Some parts of the body in the individual expresses male character and other parts express female characters.
Barr body	:	Condensed body represented by inactive chromosome found in chromosome of *Drosophila*.
DNA ligase	:	Enzyme which acts as paste molecule to join broken DNA fragments.
Holandric genes	:	Y linked genes which have no corresponding allele in X chromosome.
Haemophilia	:	A disease caused by recessive X – linked gene in which blood lacks a normal clotting substance.
Colour blindness	:	A disease caused by a recessive X linked gene in which the affected person is unable to distinguish red and green colour.
Karyotype	:	A technique by which complete set of chromosomes are separated from a cell and arranged in pairs.
Idiogram	:	Diagrammatic representation of chromosomes.
Genetic code	:	A sequence of three mRNA bases which codes for a amino acid.
Pedigree analysis	:	Study of traits as they have appeared in a given family line for several past generations.
Thalassemia	:	A autosomal recessive disorder in which abnormal haemoglobin is produced in the affected individual.
Phenyl Ketonuria	:	Inborn error of phenylalanine metabolism due to pair of autosomal recessive genes in human beings.
Albinism	:	Inborn error of metabolism caused due to autosomal recessive gene causing absence of melanin pigment in the affected individual.
Syndromes	:	Chromosomal disorders caused in human beings due to non-disjunction of chromosomes.
Cytoplasmic inheritance	:	Inheritance of characters controlled by non – nuclear genomes found in chloroplast, mitochondria etc.
Kappa particles	:	Cytoplasmic symbionts occurring in some strains of ciliated paramecium.
Eugenics	:	Application of the laws of genetics for the improvement of human race.

Evaluation

1. Haemophilia is more common in males because it is a
(a) Recessive character carried by Y-chromosome
(b) Dominant character carried by Y-chromosome
(c) Dominant trait carried by X-chromosome
(d) Recessive trait carried by X-chromosome
[Ans. (d) Recessive trait carried by X-chromosome]

2. ABO blood group in man is controlled by
(a) Multiple alleles
(b) Lethal genes
(c) Sex linked genes
(d) Y-linked genes **[Ans. (a) Multiple alleles]**

3. Three children of a family have blood groups A, AB and B. What could be the genotypes of their parents?
(a) $I^A I^B$ and ii (b) $I^A I^o$ and $I^B I^o$
(c) $I^B I^B$ and $I^A I^A$ (d) $I^A I^A$ and ii
[Ans. (b) $I^A I^o$ and $I^B I^o$]

4. Which of the following is not correct?
(a) Three or more alleles of a trait in the population are called multiple alleles.
(b) A normal gene undergoes mutations to form many alleles
(c) Multiple alleles map at different loci of a chromosome
(d) A diploid organism has only two alleles out of many in the population.
[Ans. (c) Multiple alleles map at different loci of a chromosome]

5. Which of the following phenotypes in the progeny are possible from the parental combination AxB?
(a) A and B only (b) A,B and AB only
(c) AB only (d) A,B,AB and O
[Ans. (d) A,B,AB and O]

6. Which of the following phenotypes is not possible in the progeny of the parental genotypic combination $I^A I^O$ X $I^A I^B$?
(a) AB (b) O
(c) A (d) B **[Ans. (b) O]**

7. Which of the following is true about Rh factor in the offspring of a parental combination DdXDd (both Rh positive)?
(a) All will be Rh-positive
(b) Half will be Rh positive
(c) About ¾ will be Rh negative
(d) About one fourth will be Rh negative
[Ans. (d) About one fourth will be Rh negative]

8. What can be the blood group of offspring when both parents have AB blood group?
(a) AB only (b) A, B and AB
(c) A, B, AB and O (d) A and B only
[Ans. (b) A, B and AB]

9. If the childs blood group is 'O' and fathers blood group is 'A' and mother's blood group is 'B' the genotype of the parents will be
(a) $I^A I^A$ and $I^B I^o$ (b) $I^A I^o$ and $I^B I^o$
(c) $I^A I^o$ and $I^o I^o$. (d) $I^o I^o$ and $I^B I^B$
[Ans. (b) $I^A I^o$ and $I^B I^o$]

10. XO type of sex determination and XY type of sex determination are examples of.
(a) Male heterogamety
(b) Female heterogamety
(c) Male homogamety
(d) Both (b) and (c)
[Ans. (a) Male heterogamety]

11. In an accident there is great loss of blood and there is no time to analyse the blood group which blood can be safely transferred?
(a) 'O' and Rh negative
(b) 'O' and Rh positive
(c) 'B' and Rh negative
d) 'AB' and Rh positive
[Ans. (a) 'O' and Rh negative]

12. Father of a child is colourblind and mother is carrier for colourblindness, the probability of the child being colour blind is.
(a) 25% (b) 50%
(c) 100% (d) 75%
[Ans. (b) 50%]

13. **A marriage between a colourblind man and a normal woman produces**
(a) All carrier daughters and normal sons
(b) 50% carrier daughters, 50% normal daughters
(c) 50% colourblind sons, 50% normal sons
d) All carrier offsprings
[Ans. (a) All carrier daughters and normal sons]

14. **Mangolism is a genetic disorder which is caused by the presence of an extra chromosome number.**
(a) 20 (b) 21 (c) 4 (d) 23
[Ans. (b) 21]

15. **Klinefelters' syndrome is characterized by a karyotype of**
(a) XYY (b) XO
(c) XXX (d) XXY
[Ans. (d) XXY]

16. **Females with Turners' syndrome have**
(a) Small uterus
(b) Rudimentary ovaries
(c) Underdeveloped breasts
d) All of these **[Ans. (d) All of these]**

17. **Pataus' syndrome is also referred to as**
(a) 13-Trisomy (b) 18-Trisomy
(c) 21-Trisomy. (d) None of these
[Ans. (a) 13-Trisomy]

18. **Who is the founder of Modern Eugenics movement?**
(a) Mendel (b) Darwin
(c) Francis Galton (d) Karl pearson
[Ans. (c) Francis Galton]

19. **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 euthenics (d) Positive euphenics
[Ans. (a) Positive eugenics]

20. **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]

21. **"Universal Donor" and "Universal Recipients" blood group are ___ and ___ respectively.**
(a) AB, O (b) O, AB
(c) A, B (d) B, A
[Ans. (b) O, AB]

22. **ZW-ZZ system of sex determination occurs in**
(a) Fishes (b) Reptiles
(c) Birds (d) All of these
[Ans. (d) All of these]

23. **Co-dominant blood group is**
(a) A (b) AB (c) B (d) O
[Ans. (b) AB]

24. **Which of the following is incorrect regarding ZW-ZZ type of sex determination?**
(a) It occurs in birds and some reptiles
(b) Females are homogametic and males are heterogametic
(c) Male produce two types of gametes
(d) It occurs in gypsy moth
[Ans. (b) Females are homogametic and males are heterogametic]

25. **What is haplodiploidy?**
Ans. **(i)** It is a system of sex determination in which sex of the offspring is determined by the number of sets of chromosomes it receives.
(ii) **Eg.** Honey bees in which fertilized eggs develop into females (Queen or worker bees) and unfertilized eggs develop into males (drones) by parthenogenesis.
(iii) This means males have half the number of chromosomes (haploid - *n*) and females have double the number of chromosomes (diploid - 2*n*). Hence the method is called haplodiploidy.

26. **Distinguish between heterogametic and homogametic sex determination systems?**
Ans.

Heterogametic sex determination	Homogametic sex determination
Sex chromosome may be disimilar or heter omorphic in the other sex.	Sex chromosome may be similar or homomorphic in one sex.
Heteromorphic individuals produce two types of gametes and are said to be heterogametic. **2 types** 1) Heterogametic males 2) Heterogametic females.	Individuals having homomorphic sex chromosomes provide only one type of gamete are said to be homogametic.
Eg. Males are the Heterogametic sex as they have one X and one Y chromosome (XY)	**Eg.** Females are the homogametic sex, because they have female 2 X's (XX) chromosomes.

27. What is Lyonisation?

Ans. *(i)* In the XY chromosomal system of sex determination, males have only one X chromosome, whereas females have two. In mammals the necessary dosage compensation is accomplished by the inactivation of one of the X chromosome in females so that both males and females have only one functional X chromosome per cell.

(ii) Mary Lyon suggested that Barr bodies represented an inactive chromosome, which in females becomes tightly coiled into a heterochromatin, a condensed and visible form of chromatin (Lyon's hypothesis). The number of Barr bodies observed in cell was one less than the number of X-Chromosome. XO females have no Barr body, whereas XXY males have one Barr body.

(iii) The discovery of X inactivator is attributed by British Genetician Mary Lyon and is called as Lyonisation.

28. What is criss-cross inheritance?

Ans. It is the transmission of a gene from mother to son or father to daughter. The character is inherited to the second generation through the carrier of first generation. **E.g.** Inheritance of gene causing haemophilia (x linked inheritance).

29. Why are sex linked recessive characters more common in the male human beings?

Ans. *(i)* Male human beings are hemizygous. Their sex chromosomes consist of one X and one Y chromosomes.

(ii) Sex linked character are inherited through genes in sex chromosomes since males inherit one allele only for sex linked character (one X and Y chromosomes) they express the trait commonly.

(iii) In female there are two x chromosome representing the sex chromosomes for each sex linked character. Therefore expression of the character depends on both the alleles. Sex linked inherited traits are more common in males than females because, males are hemizygous and therefore express the trait when they inherit one mutant allele.

30. What are holandric genes?

Ans. The genes present in the differential region of Y chromosome are called Y-linked or holandric genes. The Y- linked genes have no corresponding allele in X chromosome. **Eg:** Hypertrichosis

31. Mention the symptoms of Phenylketonuria.

Ans. It is characterized by severe mental retardation, light pigmentation of skin and hair. Phenylpyruvic acid is excreted in the urine.

32. Mention the symptoms of Downs syndrome.

Ans. It is characterized by severe mental retardation, defective development of the central nervous system, increased separation between the eyes, flattened nose, ears are malformed, mouth is constantly open and the tongue protrudes.

33. Differentiate Intersexes from Supersexes.

Ans. According to geneic balance theory (C. B. Bridges), the sex of an individual is determined by the ratio of X chromosome to that of its autosome sets. This ratio is termed sex index

$$\text{Sex index} = \frac{\text{Number of X Chromosomes}}{\text{Number of Sets of Autosomes}}\left(\frac{X}{A}\right)$$

Change in this ratio leads to a changed sex phenotype.

Super Sex	Inter Sex
Super sexes one of two type namely super females and super males.	These flies are intermediate between normal males and females.
Super females have a chromosome constitution 2A + XXX and the sex ratio is 1.5. These flies have an additional 'X' chromosome than the normal female and are known as metafemales. Super males have a chromosomal constitution 3A + XY and the sex ratio is 0.33. These flies have an additional sets of autosome than the normal male flies and are known as metamales.	Their chromosomal constitution is either 3A + XXY or 3A + XX.
These flies are very weak and sterile in nature.	They have a mixture of male and female sex characters and are sterile is nature.

34. Explain the genetic basis of ABO blood grouping man.

Ans. ABO system of blood grouping in humans is based on the chemical difference due to presence of antigens on the surface of the RBC and epithelial cells as follows:

Blood group	Antigen
A	Presence of A antigen
B	Presence of B antigen
O	absence of A and B antigen
AB	presence of A and B antigen

(i) Bernstein discovered that, the inheritance of different blood group in humans is determined by a number of multiple allelic series.

(ii) The three autosomal alleles located on chromosome 9 are concerned with determination of blood group.

(iii) The gene controlling blood type is labelled as 'L' or I. The gene (isoagglutination) I exists in three allelic forms I^A, I^B and I^o

(iv) I^A specifies A antigen, I^B allele determined B antigen and I^o allele specifies no antigen.

(v) Each allele (IA and IB) produces a transferase enzyme. IA allele produces N-acetyl galactose transferase and can add N-acetyl galactosamine (NAG) and IB allele encodes for the enzyme galactose transferase that adds galactose to the precursor (i.e. H substances) In the case of I^O/I^O allele no terminal transferase enzyme is produced and therefore called "null" allele and hence cannot add NAG or galactose to the precursor.

(vi) I^A and I^B are dominant to I^O but co – dominant to each other (I^A = I^B). The dominance hierarchy is given as (I^A =I^B>I^O).

(vii) A child receives one of three alleles from each parent giving rise to six positive genotypes and four possible blood type (phenotypes)

Hero types	Phenotype
I^AI^A I^AI^o	A group
I^BI^B I^BI^o	B group
I^A I^B	AB group
I^o I^o	O group

Genetic basis of the human ABO blood groups

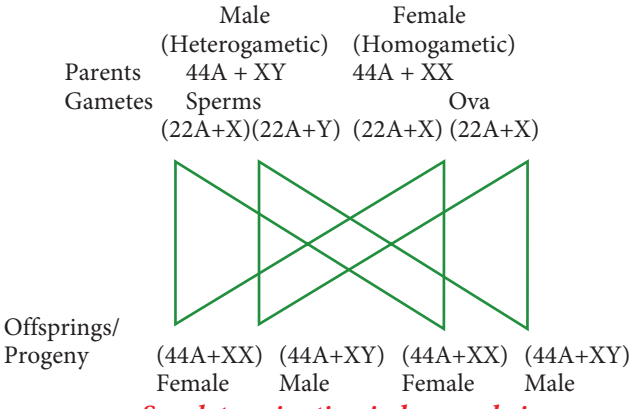
Genotype	ABO blood group phenotype	Antigens present on red blood cell	Antibodies present in blood plasma
I^AI^A	Type A	A	Anti -B
I^AI^o	Type A	A	Anti -B
I^BI^B	Type B	B	Anti -A
I^BI^o	Type B	B	Anti -A
I^AI^B	Type AB	A and B	Neither Anti - A nor Anti-B
I^oI^o	Type O	Neither A nor B	Anti -A and anti -B

35. How is sex determined in human beings?

Ans. In human beings the sex is determined by XX-XY type (Lygaeus type)

Genes determining sex in human beings are located on **two sex chromosomes, called allosomes**. In mammals, sex determination is associated with chromosomal differences between the two sexes, typically XX females and XY males. 23 pairs of human chromosomes include 22 pairs of autosomes (44A) and one pair of sex chromosomes (XX or XY). Females are homogametic producing only one type of gametes (egg), each containing one X chromosome while the males are heterogametic producing two types of sperms with X and Y chromosomes.

The sex of the embryo depends on the fertilizing sperm. An egg fertilized by an 'X' bearing sperm produces a female, if fertilized by a Y bearing sperm a male is produced.



Sex determination in human beings

36. Explain male heterogamety.

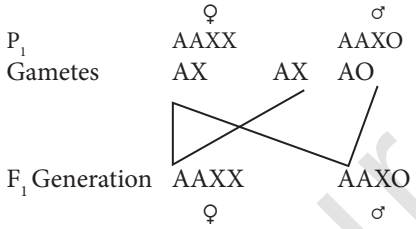
Ans. **Heterogametic Males:** In this method of sex determination the males are heterogametic producing dissimilar gametes while females are homogametic producing similar gametes. It is of kinds XX-XO type and XX-XY type.

(i) **XX-XO Type: Eg.** Cockroaches and grasshoppers.

(a) The female with two X chromosomes are homogametic (XX) while the males with only one X chromosome are heterogametic (XO).

(b) The presence of an unpaired X chromosomes determines the male sex. The males with unpaired 'X' chromosome produce two types of sperms, one half with X chromosome and other half without X chromosome.

(c) The sex of the offspring depends upon the sperm that fertilizes the egg.



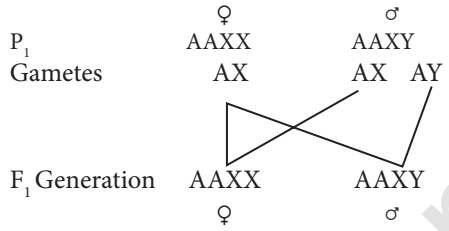
XX-XO Type of sex determination

(ii) **XX-XY type (Lygaeus Type) :** This method of sex determination is seen in human beings and in *Drosophila*.

(a) The females are homogametic with XX chromosome, while the males are heterogametic with X and Y chromosome.

(b) Homogametic females produce only one kind of egg, each with one X chromosome, while the heterogametic males produce two kinds of sperms some with X chromosome and some with Y chromosome.

(c) The sex of the embryo depends on the fertilizing sperm. An egg fertilized by an 'X' bearing sperm produces a female, if fertilized by a 'Y' bearing sperm, a male is produced.



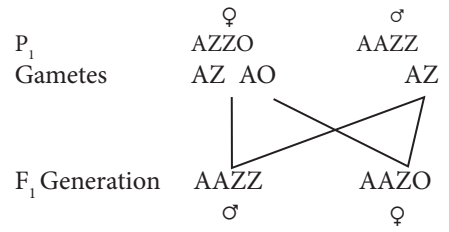
XX-XY Type of sex determination

37. Brief about female heterogamety.

Ans. **Heterogametic Females:** In this method of sex determination, the homogametic male possesses two 'X' chromosomes as in certain insects and certain vertebrates like fishes, reptiles and birds producing a single type of gamete; while females produce dissimilar gametes.

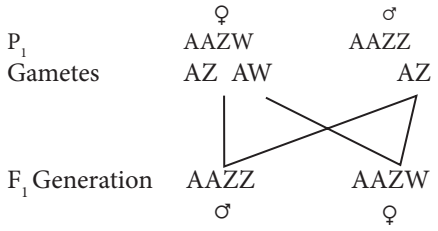
The female sex consists of a single 'X' chromosome or one 'X' and one 'Y' chromosome. Thus the females are heterogametic and produce two types of eggs. Heterogametic females are of two types, ZO-ZZ type and ZW-ZZ type.

(i) **ZO-ZZ Type: Eg.** Certain moths, butterflies and domestic chickens. In this type, the female possesses single 'Z' chromosome in its body cells and is heterogametic (ZO) producing two kinds of eggs some with 'Z' chromosome and some without 'Z' chromosome, while the male possesses two 'Z' chromosomes and is homogametic (ZZ).



ZO-ZZ Type of sex determination

(ii) **ZW-ZZ type: Eg.** Insects (gypsy moth) and in vertebrates such as fishes. In this method the female has one 'Z' and one 'W' chromosome (ZW) producing two types of eggs, some carrying the Z chromosomes and some carry the W chromosome. The male sex has two 'Z' chromosomes and is homogametic (ZZ) producing a single type of sperm.



ZW-ZZ Type of sex determination

38. Give an account of genetic control of Rh factor.

Ans. The term Rh factor refers to the immunogenic D antigen of Rh blood group system.

Genetic control of Rh factor

(i) **Fisher and Race hypothesis:** Rh factor involves three different pairs of alleles located on three different closely linked loci on the chromosome pair. This system is more commonly in use today, and uses the 'Cde' nomenclature.

(ii) Three pairs of Rh alleles (Cc, Dd and Ee) occur at 3 different loci on homologous chromosome pair-1. The possible genotypes will be one C or c, one D or d, one E or e from each chromosome. For **E.g.** CDE/cde; CdE/cDe; cde/cde; CDe/CdE etc., All genotypes carrying a dominant 'D' allele will produce Rh^+positive phenotype and double recessive genotype 'dd' will give rise to Rh^- negative phenotype.

(iii) **Wiener Hypothesis** Wiener proposed the existence of eight alleles (R^1, R^2, R^0, R^z, r, r^1, r^{11}, r^y) at a single Rh locus. All genotypes carrying a dominant 'R allele' (R^1, R^2, R^0, R^z) will produce Rh^+positive' phenotype and double recessive genotypes (rr, rr^1, rr^{11}, rr^y) will give rise to Rh-negative phenotype.

39. Explain the mode of sex determination in honeybees.

Ans. *(i)* In hymenopteran insects such as honeybees, ants and wasps a mechanism of sex determination called **haplodiploidy** mechanism of sex determination is common.

(ii) In this system, the sex of the offspring is determined by the number of sets of chromosomes it receives. Fertilized eggs develop into females (Queen or Worker) and unfertilized eggs develop into males (drones) by parthenogenesis. It means that the males have half the number of chromosomes (haploid) and the females have double the number (diploid), hence the name haplodiplody for this system of sex determination.

(iii) This mode of sex determination facilitates the evolution of sociality in which only one diploid female becomes a queen and lays the eggs for the colony.

(iv) All other females which are diploid having developed from fertilized eggs help to raise the queen's eggs and so contribute to the queen's reproductive success and indirectly to their own, a phenomenon known as Kin Selection.

(v) The queen constructs their social environment by releasing a hormone that suppresses fertility of the workers.

40. Discuss the genic balance mechanism of sex determination with reference to *Drosophila*.

Ans. *(i)* Genic balance mechanisms of sex determination in *Drosophila* was first studied by C. B. Bridges.

(ii) In *Drosophila*, the presence of Y chromosome is essential for the fertility of male sex, but does not determine the male sex.

(iii) The gene for femaleness is located on the X chromosome and those for maleness are located on the autosomes.

(iv) When geneticist C. B. Bridges, working with *Drosophila*, crossed a triploid (3n) female with a normal male, he observed many combinations of autosomes and sex chromosomes in the offspring.

(v) He suggested that sex in *Drosophila* is determined by the balance between the genes for femaleness located on the 'X' chromosomes and those for maleness located on the 'autosomes' . Hence the sex of an individual is determined by the ratio of its X chromosome to that of its autosome sets. This ratio is termed sex index and is expressed as:

$$\text{Sex index} = \frac{\text{Number of X Chromosomes}}{\text{Number of Sets of Autosomes}}\left(\frac{X}{A}\right)$$

(vi) Change in this ratio leads to a changed sex phenotype. The results obtained from a cross between triploid female *Drosophila* (3A:3X) with a diploid male (2A: XY) is shown in below.

(vii) Bridges classical cross of a triploid (3A+XXX) female fly and a diploid (2A+XY) male fly

	Triploid ♀	Diploid ♂
Parent	3A + XXX	2A + XY
Gametes	(2A + XX) (A + X) (2A + X) (A + XX)	(A + X) (A + Y)

	A + X	A + Y
2A + XX	3A + XXX Triplod Female	3A + XXY Triploid Intersex
2A + X	3A + XX Triploid Intersex	3A + XY Super Male
A + XX	2A + XXX Super female	2A + XXY Diploid Female
A + X	2A + XX Diploid Female	2A + XY Diploid Male

Different doses of X chromosomes and autosome sets and their effect on sex determination in Drosophila

Phenotype		Number of 'X' Chromosomes (X)	Number of Autosome sets (A)	Sex Index = Number of X chromosome / Number of autosome sets
Meta female / Super female		3	2	3/2 = 1.5
Normal Female	Tetraploid	4	4	4/4 = 1.0
	Triploid	3	3	3/3 = 1.0
	Diploid	2	2	2/2 = 1.0
	Haploid	1	1	1/1 = 1.0
Inter sex		2	3	2/3 = 0.67
Normal male		1	2	½ =0.50
Meta male / Super male		1	3	1/3 = 0.33

A sex–switch gene in *Drosophila* directs female development. This gene, sex–lethal (SxL) located on the X chromosome, has two states of activity. When it is 'on' it directs female development and when it is 'off ' maleness ensures. Other genes located on the X chromosome and autosomes regulate this sex-switch gene. However, the Y- chromosome of *Drosophila* is required for male fertility.

41. What are the applications of Karyotyping?

Ans. *(i)* It helps in gender identification.

(ii) It is used to detect the chromosomal aberrations like deletion, duplication, translocation, nondisjunction of chromosomes.

(iii) It helps to identify the abnormalities of chromosomes like aneuploidy.

(iv) It is also used in predicting the evolutionary relationships between species.

(v) Genetic diseases in human beings can be detected by this technique.

42. Explain the inheritance of sex linked characters in human being.

Ans. *(i)* The inheritance of a trait that is determined by a gene located on one of the sex chromosomes is called sex linked inheritance.

(ii) Genes present on the differential region of X or Y chromosomes are called sex linked genes. The genes present in the differential region of "X" chromosome are called X linked genes. The X–linked genes have no corresponding alleles in the Y chromosome.

(iii) The genes present in the differential region of Y chromosome are called Y- linked or holandric genes. The Y linked genes have no corresponding allele in X chromosome.

(iv) The Y linked genes inherit along with Y chromosome and they phenotypically express only in the male sex.

(v) Sex linked inherited traits are more common in males than females because, males are hemizygous and therefore express the trait when they inherit one mutant allele.

(vi) The X – linked and Y – linked genes in the differential region (non–homologus region) do not undergo pairing or crossing over during meiosis. **The inheritance of X or Y linked genes is called sex-linked inheritance.**

X linked Inheritance - **Eg.** Colour blindness

Y linked Inheritance - **Eg.** hypertrichosis

43. What is extra chromosomal inheritance? Explain with an example.

Ans. *(i)* Certain characters are controlled by non-nuclear genomes found in chloroplast, mitochondria, infective agents and plasmids. These characters do not reveal Mendelian pattern of inheritance.

(ii) The inheritance of the extra chromosomal genes are found to exhibit maternal influence.

(iii) Although both male and female parents contribute equally to the zygote in terms of chromosomal genes, the female parent usually contributes the zygote's initial cytoplasm and organelles, since the sperms contain very little cytoplasm. If there are hereditary units in the cytoplasm, these will be transmitted to the offsprings through the egg, so the offsprings exhibit maternal effect.

(iv) The cytoplasmic extranuclear genes have a characteristic pattern of inheritance which do not resemble the genes of nuclear chromosomes and is known as extra chromosomal or extra nuclear or cytoplasmic inheritance and exhibit maternal influence.

(v) In extra nuclear inheritance, male and female parents contribute equally their nuclear genes to the progeny but do not make equal contribution of extra chromosomal genes hence, the crosses can yield different (or) non Mendelian results. Extra chromosomal inheritance in *Limnaea peregra*.

(vi) *Limnaea peregra* is a freshwater snail. The shell of these animals are spirally coiled. The coiling of the shell is clockwise (dextral) or anticlockwise (sinistral).

(vii) Both type of coilings are produced by two different types of genetically controlled cleavages namely, dextral cleavage and sinistral cleavage.

(viii) In *Limnaea*, dextral coiling is normal and sinistral coiling is a mutant character.

(ix) Direction of coiling is determined by a pair of nuclear genes, D(dextral) and d (sinistral). The gene for dextral (D) being dominant over sinistral coiling (d). In Fig. a dextral snail provides the eggs and a sinistral snail provides the sperm. The offsprings are all dextral (Dd), in the F_1 generation.

(x) When the F_1 heterozygous dextral individual (Dd) were self crossed the F_2 generation showed dextral coiling with genotype of 1DD, 2Dd and 1dd.

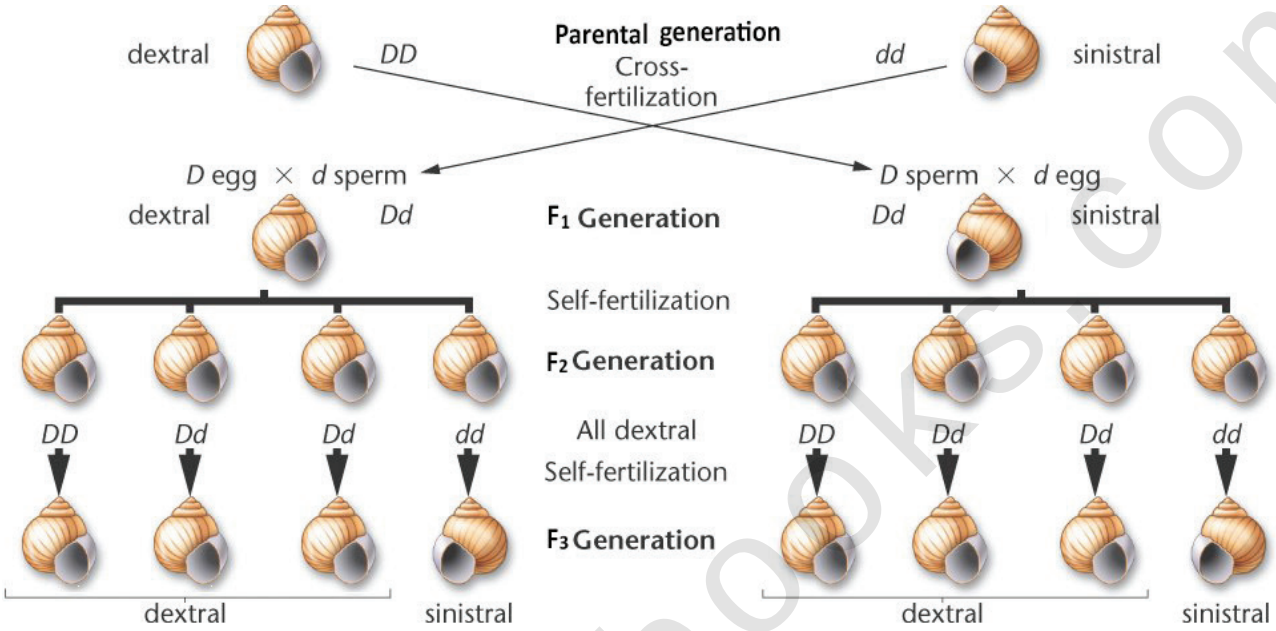
(xi) When a reciprocal cross is made the F_1 individuals have Dd genotype but are coiled sinistrally, as in the female parent. In both the crosses the F_1 are phenotypically similar to the female parent, though the offsprings in both crosses have the same genotype Dd. This is because the genotype of the maternal parent determines the phenotype of the offspring.

(xii) When the F_1 sinistral individuals were self crossed, the shell coiling in the F_2 generation, were all dextral. This is because the genes do not segregate in the F_2 generation. Only in the F_3 generation segregation occurs in the ratio of 3 dextral : 1 sinistral.

(xiii) **Reason:** The type of cleavage depends on the organization of the egg which is established before the maturation division of the oocyte nucleus and by the influence of the maternal genotype.

(xiv) The direction of coiling of the shell depends upon the orientation of the mitotic spindle during the first cleavage.

(xv) Obviously, maternal control affects only one generation. In each generation the coiling is dependent on the maternal genotype.



3 dextral: 1 sinistral

Shell coiling in *Limnaea*

44. Comment on the methods of eugenics.

Ans. Application of the laws of genetics for the improvement of human race is called **eugenics.**

Two methods of Eugenics are:

(i) Constructive method or Positive eugenics

(ii) Restrictive method or Negative eugenics

(i) **Positive eugenics:** 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:

(a) Early marriage of those having desirable traits

(b) Subsiding the fit and establishing sperm and egg banks of precious germ plasm.

(c) Educating the basic principles of genetics and eugenics.

(d) Improvement of environmental conditions.

(e) Promotion of genetic research.

(ii) **Negative eugenics:** Negative eugenics attempts to eliminate the defective germplasm of the society by adopting the following measures:

(a) Sexual separation of the defectives

(b) Sterilization of the defectives

(c) Control of immigration and

(d) Regulation of marriages

Additional Questions

Choose the Correct Answer 1 Mark

I. Choose the Correct options for the below Questions

1. The blood group _____ is called universal donor.
(a) A (b) AB
(c) B (d) O [Ans. (d) O]

2. The blood group _____ is called universal recipient.
(a) AB (b) O
(c) B (d) A
[Ans. (b) AB]

3. The ABO blood group was discovered by _____.
(a) Sturli (b) Decastelle
(c) Landsteiner
(d) Alexander wiener [Ans. (c) Landsteiner]

4. The inheritance of blood group is determined by multiple alleles as discovered by_____.
(a) Landsteiner (b) Bernstein
(c) Alexander castelle (d) lyon
[Ans. (b) Bernstein]

5. The _____ is called null allele.
(a) I^A (b) $I^O I^B$
(c) I^O (d) $I^B I^B$
[Ans. (c) I^O]

6. The secretors have the I allele in _____.
(a) tears (b) Gastric juice
(c) Saliva (d) All of these
[Ans. (d) all of these]

7. _____ proposed the existence of 8 alleles at a single Rh locus.
(a) Fischer (b) Landsteiner
(c) Bernstein (d) Wiener
[Ans. (d) Wiener]

8. XX – XO type of sex determination is in _____
(a) Cockroaches (b) *Drosophila*
(c) Humans (d) Moths
[Ans. (a) Cockroaches]

9. The lygaeus type (XX – XY) type of sex determination is seen in _____.
(a) Fishes (b) Chickens
(c) Human beings (d) Gypsy moth
[Ans. (c) Human beings]

10. The ZO – ZZ type of sex determination is seen is _____.
(a) moths (b) Reptiles
(c) Human beings (d) Bugs
[Ans. (a) moths]

11. The ZW – ZZ type of sex determination is seen is _____
(a) Butterflies (b) Drosophila
(c) Gypsy moth (d) Human being
[Ans. (c) Gypsy moth]

12. Sex index is applicable to _____
(a) Homogenetic condition
(b) Heterogametic condition
(c) Genic balance
(d) Gynandromorphs [Ans. (c) Genic balance]

13. X chromosomes was discovered by _____.
(a) Landsteiner (b) Henking
(c) Stevens (d) Bridges
[Ans. (b) Henking]

14. Y chromosomes was discovered by _____
(a) Stevens (b) Landsteiner
(c) Henking (d) Wiener
[Ans. (a) Stevens]

15. _____was first reported by John Cotto.
(a) Erythroblastosis foetalis
(b) Haemophilia
(c) Colour blindness
(d) Haplodiploidy [Ans. (b) Haemophilia]

16. Scientists who contributed to karyotyping ___
(a) Tjio and Levan (b) John Cotto
(c) Bridges (d) Wiener
[Ans. (a) Tjio and Levan]

17. Depending on position of centromere and relative length of two arms human chromosomes can be classified into ____ type.
(a) 2 (b) 3
(c) 4 (d) 5 [Ans. (c) 4]

18. _____ are examples of mendelian disorders.
(a) Thalassemia (b) Albinism
(c) Phenylketonuria (d) Haemophilia
[*Ans.* (d) Haemophilia]

19. _____ is a disease where abnormal haemoglobin is produced in patients.
(a) Phenylketonuria
(b) Huntington's chorea
(c) Thalassemia (d) Albinism
[*Ans.* (c) Thalassemia]

20. Phenylketonuria is linked to chromosome __.
(a) 9 (b) 10
(c) 12 (d) 8 [*Ans.* (c) 12]

21. Cooley's anaemia refers to _____
(a) Phenylketonuria (b) Haemophilia
(c) Thalassemia
(d) Turner's sundrome [*Ans.* (c) Thalassemia]

22. The gene responsible for _____ is inherited as an autosomal recessive lethal gene in man
(a) Huntington's chorea
(b) Albinism
(c) Colourblindness
(d) Phenylketonuria [*Ans.* (b) Albinism]

23. _____ is an inborn error of metabolism caused due to autosomal recessive gene.
(a) Thalassemia (b) Albinism
(c) Phenylketonuria
(d) Huntington's chorea [*Ans.* (b) Albinism]

24. Trisomy 21 refers to _____
(a) Patau's syndrome
(b) Down's syndrome
(c) Klinefilters syndrome
(d) Turners syndrome
[*Ans.* (b) Down's syndrome]

25. Patau's syndrome is called _____.
(a) Trisomy – 21 (b) Trisomy-13
(c) xxy males (d) xo females
[*Ans.* (b) Trisomy-13]

26. People with _____ have 45 chromosomes.
(a) Turner's syndrome
(b) Klinefelter's syndrome
(c) Down's syndrome
(d) Patau's syndrome
[*Ans.* (a) Turner's syndrome]

II. Choose the Correct options for the below Fill in the blanks:

1. Incompatibility of blood groups leading to, clumping of erythrocytes is called _____.
(a) agglutination
(b) non-agglutination
(c) Inhibition
(d) repolarization [*Ans.* (a) agglutination]

2. One gene 'L' controlling blood groups is named after _____
(a) C. B. Bridges (b) Henking
(c) Landsteiner (d) Stevens
[*Ans.* (c) Landsteiner]

3. The allele I° is called _____.
(a) Dominant allele (b) null allele
(c) Co-dominant allele (d) epistatic allele
[*Ans.* (b) null allele]

4. The alleles I^A and I^B are _____
(a) Hypostatic
(b) Co-dominant
(c) Recessive
(d) Epistatic [*Ans.* (b) Co-dominant]

5. Individuals who possess the I antigens related to gene I in body fluids are called_____.
(a) secretors (b) enzymes
(c) Lymph fluids (d) hormones
[*Ans.* (a) secretors]

6. Rh factor was discovered in the blood of _____.
(a) Frog (b) Carp
(c) Rhesus monkey (d) Calotes
[*Ans.* (c) Rhesus monkey]

7. Incompatibility of Rh factor can lead to _____ in a pregnant woman.
(a) Haemophilia
(b) Sickle cell anaemia
(c) Aplastic anaemia
(d) erythroblastosis foetalis
[*Ans.* (d) erythroblastosis foetalis]

8. The XX – XY type of sex determination is also known as _____ type.
(a) Haploid - diploid (b) Lygaeus
(c) Gynandromorphs (d) Genic balance
[*Ans.* (b) Lygaeus]

9. In gypsy moth we find _____ type of sex determination.
(a) ZW – ZZ (b) XX - XY
(c) XX - XO (d) ZO - ZZ
[*Ans.* (a) ZW – ZZ]

10. Genic balance mechanism was first studied by _____.
(a) John Cotto (b) C. B. Bridges
(c) Bernstein (d) Wiener
[*Ans.* (b) C. B. Bridges]

11. Sex switch genes have been reported in _____.
(a) Grasshopper (b) Cockroach
(c) Wasp (d) *Drosophila*
[*Ans.* (d) *Drosophila*]

12. In _____ the tissues of male and female genotype type form a mosaic.
(a) Haplo-diploidy
(b) Gynandromorphy
(c) Genic balance
(d) Lygaeus type [*Ans.* (b) Gynandromorphy]

13. Sex chromatin is also called as _____.
(a) polar body (b) nucleus
(c) nucleolus (d) Barr body
[*Ans.* (d) Barr body]

14. The number of Barr bodies follows _____.
(a) N-0 Rule (b) N-3 rule
(c) N-1 rule (d) N-2 rule
[*Ans.* (c) N-1 rule]

15. Kin selection is seen in _____.
(a) Honey bees (b) Drosophila
(c) Grasshopper (d) Cockroach
[*Ans.* (a) Honey bees]

IV Identify the correct Statements

1. (i) Y linked genes are transmitted from mother to son.
(ii) People with $I^A I^O$ genotype have O blood group.
(iii) Human Y chromosome is shorter than X chromosome.
(iv) Fertilized eggs develop into Drones
(a) i,iv (b) ii,iii,iv
(c) i and iii (d) iii only
[*Ans.* (d) iii only]

2. (i) The females are carriers of haemophilia
(ii) Albinism is classified into alpha and beta types.
(iii) The symbol  stands for mating.
(iv) XXY females suffer from Klinefelters syndrome
(a) i, iii and iv (b) ii and iv
(c) i and iii (d) iv only
[*Ans.* (c) i and iii]

V. Match the following

1.

1.	Kappa	(a) eugenics
2.	Phenyl pyruvic acid	(b) hypertrichosis
3.	Germplasm	(c) chromosome 12
4.	Holandric genes	(d) bacterium

(A) 1 – c 2 – d 3 – b 4 – a
(B) 1 – d 2 – a 3 – b 4 – c
(C) 1 – d 2 – c 3 – a 4 – b
(D) 1 – c 2 – b 3 – a 4 – d
[*Ans.* (C) 1–d 2–c 3–a 4–b]

2.

1.	Karyotyping	(a) Metaphase
2.	XO females	(b) Barr body
3.	3n female	(c) Aneuploidy
4.	Lyon	(d) Bridges

(a) 1 - a 2 - c 3 - d 4 - b
(b) 1 - c 2 - b 3 - d 4 - a
(c) 1 - b 2 - d 3 - a 4 - c
(d) 1 - c 2 - a 3 - d 4 - b
[*Ans.* (A) 1-a 2-c 3-d 4-b]

3.

1. I	A. Fischer
2. R^1	B. Bridges
3. Cde	C. Landsteiner
4. X/A	D. Wiener

(A) 1 - b 2 - c 3 - d 4 - a
(B) 1 - a 2 - c 3 - d 4 - b
(C) 1 - d 2 - c 3 - a 4 - b
(D) 1 - c 2 - d 3 - a 4 - b
[*Ans.* (D) 1-c 2-d 3-a 4-b]

VI Identify the correct assertion and reason:

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. A and R are true, R is the correct explanation of A.
B. A and R are true, R is not the correct explanation of A.
C. A is true, R is false.
D. Both A and R are false.

1. **Assertion :** ABO Blood grouping is based on multiple alleles.
Reason : There are 6 possible genotypes and 4 possible blood types

[Ans. (a) A and R are true, R is the correct explanation of A]

2. **Assertion :** The Kappa in paramecium appears to be a bacterium.
Reason : Kappa particles are not dependent on the chromosomal genes.

[Ans. (c) A is true, R is false]

3. **Assertion :** Phenylketonuria occurs due to the mutation in gene PAH on chromosome 11.
Reason : DOPA is not converted to melanin.

[Ans. (d) Both A and R are false]

VII Identify the Incorrect pair from the below:

1. **(i) Downs syndrome - Trisomy 13**
(ii) Shell coiling in snail - Cytoplasmic inheritance
(iii) Kappa particle - Sonneborn
(iv) Eugenics - Galton
(a) i and iv (b) i only
(c) ii and iii (d) i, ii and iv

[Ans. (b) i only]

2. **(i) SRY - X Chromosome**
(ii) Heterogametic female - XX–XO
(iii) Barr body - Sex Chromatin
(iv) Rh factor - Landsteiner
(a) i and iv (b) ii and iii and iv
(c) ii only (d) i and ii

[Ans. (c) ii only]

VIII Identify the Odd-man out from the below

1. (a) I^o (b) Rh
(c) I^B (d) I^A **[Ans. (b) Rh]**

Reason: It belongs to Rh Blood grouping whereas the others come under ABO Blood groups.

2. (a) Cockroaches (b) *Drosophila*
(c) Human beings (d) Butterflies

[Ans. (d) Butterflies]

Reason: They are heterogametic females whereas the others are heterogametic males.

3. (a) 22A + X (b) 22A + Y
(c) 44AA + XY (d) 22AA + XY

[Ans. (d) 22AA + XY]

Reason: It is an abnormal chromosomal complement of human whereas others are normal chromosomal complements of a human.

4. (a) Hemophilia (b) Colour blindness
(c) Turner's syndrome
(d) Muscular Dystrophy

[Ans. (c) Turner's syndrome]

Reason: It is a disease caused due to chromosomal abnormality whereas the others are disease due to X linked genes.

5. (a) Barr body (b) kin selection
(c) honey bees (d) Haplodiploidy

[Ans. (a) Barr body]

Reason: It deals with dosage compensation in sex determination whereas others linked to haplodiploidy

Answer in one word*

1. Y linked genes are also called _____.

[Ans. holandric genes]

2. Sex linked traits are more common in males because they are _____.

[Ans. hemizygous]

3. Red – green colour blindness is also called _____

[Ans. daltonism]

4. Persons suffering from haemophilia lack the clotting substance called _____.

[Ans. thromboplastin]

* Only for quick revision not in pattern

5. Hemophilia follows _____ pattern of Inheritance. [Ans. criss – cross]

6. Cell division in cells can be arrested by use of a substance called _____ [Ans. colchicines]

7. For karyotype cells in _____ stages of cell division are photographed [Ans. metaphase]

8. Genetic disease in human can be detected by the technique _____. [Ans. karyotyping]

9. _____ is a family tree. [Ansz pedigree]

10. Absence of melanin results in a condition called _____. [Ans. Albinism]

11. In skin during pigment formation DOPA is converted into _____ [Ans. melanin]

12. The enzyme _____ converts DOPA to Melanin. [Ans. Tyrosinase]

13. Involuntary jerking of the body and degeneration of nervous system are symptoms of _____. [Ans. Huntington's chorea]

14. _____ is an example of Autosomal aneuploidy in humans. [Ans. Down's syndrome/Patau's syndrome]

15. _____ is an example of Allosomal abnormality in humans. [Ans. Klinefelter's syndrome / Turner's syndrome]

16. Shell coiling in Limnaea exhibits _____ inheritance. [Ans. Extra chromosomal / Cytoplasmic]

17. Kappa particles in paramecium were studied by _____. [Ans. Sonneborn]

18. The killer paramecia are said to posses _____. [Ans. kappa particle]

19. The kappa particles liberates a toxin called __ [Ans. paramecin]

20. The term _____ means well born. [Ans. Eugenics]

21. The term eugenics was coined by _____. [Ans. Francis Galton]

22. The term Euphenics was coined by _____. [Ans. Joshua Lederberg]

23. The science of improving human race by improving environmental conditions is called _____. [Ans. Euthenics]

Very Short Answers — 2 Marks

1. Mention two measures under negative eugenics.

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

2. Mention the symptoms seen in trisomy 13/ Pataus's syndrome.

Ans. It is characterized by multiple and severe body malformations as well as profound mental deficiency. Small head with small eyes, cleft palate, malformation of the brain and internal organs are some of the symptoms of this syndrome.

3. What is a syndrome?

Ans. Group of signs and symptoms that occur together and characterize a particular abnormality is called a syndrome. In humans, Down's syndrome, Turner's syndrome, Klinefelter's syndrome, Patau's syndrome are some of the examples of chromosomal disorders.

4. What is Lyon's hypothesis?

Ans. Mary Lyon suggested that Barr bodies represented an inactive chromosome, which in females becomes tightly coiled into a heterochromatin, a condensed and visible form of chromatin. The number of Barr bodies observed in cell was one less than the number of X-Chromosome. XO females have no Barr body, whereas XXY males have one Barr body.

5. What are Gynandromorphy?

Ans. These individuals have parts of their body expressing male characters and other parts of the body expressing female characters. The organism is made up of tissues of male and female genotype and represents a mosaic pattern.

6. How does hemophilia affect an individual?

Ans. A person with a recessive gene for haemophilia lacks a normal clotting substance (thromboplastin) in blood, hence minor injuries cause continuous bleeding, leading to death.

7. What is Rh factor or Rh antigen?

Ans. **(i)** Rh factor is a immunogenic D antigen of the Rh blood group system found on the surface of the erythrocytes of Rhesus monkey and human beings. In the blood it is inherited as a dominant trait.

(ii) An individual having D antigen are Rh D (Rh^+) and those without D antigen are Rh D negative (Rh^-).

SHORT ANSWERS — 3 Marks

1. Why are people with O blood group called as universal donors?

Ans. People with 'O' blood group lack both 'A' and 'B' antigens. Therefore when 'O' blood is donated to another individual, his blood will not produce any antibodies against it. Therefore people with 'O' blood group are called as universal donors.

2. 'AB' Blood group individuals are called universal recipients. Justify.

Ans. People with AB blood group have both 'A' antigen and B antigen in their RBCs. Therefore they can receive blood from 'A' group, 'B' group or 'O' group individuals their blood will not produce antibodies against any of them. Therefore people with 'AB' blood group are called as universal recipients.

3. What is null allele?

Ans. In ABO blood group, each allele (I^A and I^B) produces a transferase enzyme. I^A allele produces N-acetyl galactose transferase and can add N-acetyl galactosamine (NAG) and I^B allele encodes for the enzyme galactose transferase that adds galactose to the precursor (i.e. H substances) In the case of I^O/I^O allele no terminal transferase enzyme is produced and therefore called "null" allele and hence cannot add NAG or galactose to the precursor.

4. How can erythroblasts foetalis be prevented?

Ans. If the mother is Rh negative and foetus is Rh positive, anti D antibodies should be administered to the mother at 28th and 34th week of gestation as a prophylactic measure. If the Rh negative mother delivers Rh positive child then anti D antibodies should be administered to the mother soon after delivery. This develops passive immunity and prevents the formation of anti D antibodies in the mothers blood by destroying the Rh foetal RBC before the mother's immune system is sensitized. This has to be done whenever the woman attains pregnancy.

5. Draw a schematic representation to show ZW – ZZ type of sex determination.

Ans.

	♀	♂
P_1	AAZW	AAZZ
Gametes	AZ AW	AZ
F_1 Generation	AAZZ ♂	AAZW ♀

6. What is SRY?

Ans. SRY stands for sex determining region Y. It is a gene found in the euchromatin regions of the Non–combining region of Y chromosome. It codes for testes determining factor (TDF) present in testes of Males. This gene does not occur in X chromosome.

7. What is sex Index?

Ans. In *Drosophila* the sex is determined by the balance between the genes for femaleness located on the 'X' chromosome and those for maleness located on the 'autosomes' (A). Hence the sex of an individual is determined by the ratio of its X chromosome to that of the autosome A sets. This ratio is termed as sex index and is expressed as

$$\text{Sex Index} = \frac{\text{Number of X chromosomes (X)}}{\text{Number of sets of autosomes (A)}}$$

change in this ratio leads to a changed sex phenotype.

8. Females are carriers of Haemophilia. Give Reason.

Ans. Haemophilia is a disease caused by a recessive X – linked gene. If a normal female marries a colour blind male or vice versa, the gene is carried in the X – chromosome of the female (female has 2 X Chromosomes). If both the chromosomes carry the receive gene she becomes colour blind. If one X chromosome caries the recessive gene she may not suffer from the disease but will be a carrier carrying the gene to the next generation. Haemophilia follows the characteristics criss - cross pattern of inheritance. The females are carriers of the disease and world transmit the disease to 50% of their son's even if a male parent is normal.

9. What is the role of the gene responsible for colour blindness in a normal human beings?

Ans. A dominant X – linked gene is necessary for the formation of colour sensitive cells, the cones. which helps to distinguish colours. A recessive form of the gene is incapable of producing the cones. Hence the affected person is unable to distinguish red and green colour.

10. What are Y linked or holandric genes?

Ans. *(i)* The genes present in the non-homologous region of the Y chromosome are called Y - linked genes or holandric genes.

(ii) The Y - linked genes have no corresponding allele in X - chromosome.

(iii) These genes are transmitted directly from father to son, because males inherit the Y chromosome from the father.

(iv) **Eg.** Gene for Hypertrichosis (excessive development of hairs on pinna of the ear).

11. What is karyotyping?

Ans. Karyotyping is a technique through which a complete set of chromosomes is separated from a cell and the chromosomes are arranged in pairs. An idiogram refers to a diagrammatic representation of chromosomes.

12. What is Pedigree analysis?

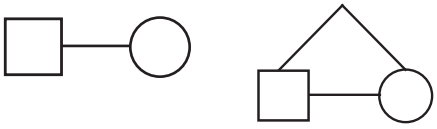
Ans. Pedigree is a "family tree", drawn with standard genetic symbols, showing the inheritance pathway for specific phenotypic characters. Pedigree analysis is the study of traits as they have appeared in a given family line for several past generations.

13. What are Mendelian disorders?

Ans. Alteration or mutation in a single gene causes Mendelian disorders. These disorders are transmitted to the offsprings on the same line as the Mendelian pattern of inheritance. Some examples for Mendelian disorders are Thalassemia, albinism, phenylketonuria, etc. These disorders may be dominant or recessive and autosomal or sex linked.

14. Draw the symbols for
(a) Mating (b) Dizygotic twins.

Ans. Mating Dizygotic twins



15. What is the chemical reaction that is affected in people suffering from Albinism?

Ans. 3,4 *dihydroxy phenylalanine* (DOPA) $\xrightarrow{Tyrosinase}$ *Melanin*

Affected individuals lack the *tyrosinase* enzyme which converts DOPA to melanin pigment responsible for skin colour. It is caused due to autosomal recessive genes.

16. What is the reason for the occurrence of chromosomal abnormalities?

Ans. *(i)* Chromosomal disorders are caused by errors in the number or structure of chromosomes.

(ii) Chromosomal anomalies usually occur when there is an error in cell division. Failure of chromatids to segregate during cell division resulting in the gain or loss of one or more chromosomes is called aneuploidy. It is caused by non-disjunction of chromosomes. **Eg.** Down's syndrome.

17. What is extra chromosomal or cytoplasmic inheritance.

Ans. Certain characters are controlled by non – nucleas genomes found in chloroplast, Mitochondria, infective agents and plasmids, and do not reveal Mendelian pattern of Inheritance. This is called as extra chromosomal inheritance. They exhibit maternal influence in their pattern of inheritance. **Eg.** Inheritance of the shell coiling pattern in fresh water snail *Limnaea peregra*.

18. What are Kappa particles.

Ans. They are cytoplasmic symbionts occurring in some strains of the ciliated paramecium which have their own DNA. It liberates a toxin paramecin and strains which possess these particles are called 'killer paramecia'. Inheritance of killer trait, is by extra chromosomal inheritance.

19. What is euphenics?

Ans. The symptomatic treatment of genetic disease of man is called Euphenics or Medical engineering. In 1960, Joshua Lederberg coined the term euphenics. It means normal appearing. It deals with the control of several inherited human diseases especially the inborn errors of metabolism. Eg. Phenylketonuria (PKU)

20. What is euthenics?

Ans. The science of improvement of existing human race by improving the environmental conditions is called euthenics. It can be achieved by subjecting them to better nutrition, better unpolluted ecological conditions, better education and sufficient medical facilities.

21. What is erythoblastosis foetalis (or) Haemolytic disease of the new born (HDN)? (or) Write about the incompatiability of Rh-factor.

Ans. *(i)* Rh incompatability has great significance in child birth. If a woman is Rh negative and the man is Rh positive, the foetus may be Rh positive having inherited the factor from its father.

(ii) The Rh negative mother becomes sensitized by carrying Rh positive foetus within her body.

(iii) Due to damage of blood vessels, during child birth, the mother's immune system recognizes the Rh antigens and gets sensitized. The sensitized mother produces Rh antibodies.

(iv) The antibodies are IgG type which are small and can cross placenta and enter the foetal circulation. By the time the mother gets sensitized and produce anti 'D' antibodies, the child is delivered.

(v) Usually no effects are associated with exposure of the mother to Rh positive antigen during the first child birth, subsequent Rh positive children carried by the same mother, may be exposed to antibodies produced by the mother against Rh antigen, which are carried across the placenta into the foetal blood circulation.

(vi) This causes haemolysis of foetal RBCs resulting in haemolytic jaundice and anaemia. This condition is known as Erythoblastosis foetalis or Haemolytic disease of the new born (HDN).

22. Define Kin selection.

Ans. The mode of sex determination which facilitates the evolution of sociality in which only one diploid female becomes a queen and lays the eggs for the colony. All other females which are diploid having developed from fertilized eggs help to raise the queen's eggs and so contribute to the queen's reproductive success and indirectly to their own, a phenomenon known as Kin Selection. The queen constructs their social environment by releasing a hormone that suppresses fertility of the workers. **Eg.** Honey bees.

23. What is Sex-switch gene?

Ans. *(i)* A gene, sex–lethal (SxL) located on the X chromosome, in *Drosophila* directs female development.

(ii) This gene has two states of activity. When it is 'on' it directs female development and when it is 'off' maleness ensures.

(iii) Other genes located on the X chromosome and autosomes regulates sex switch gene.

(iv) However, the Y chromosome of *Drosophila* is required for male fertility.

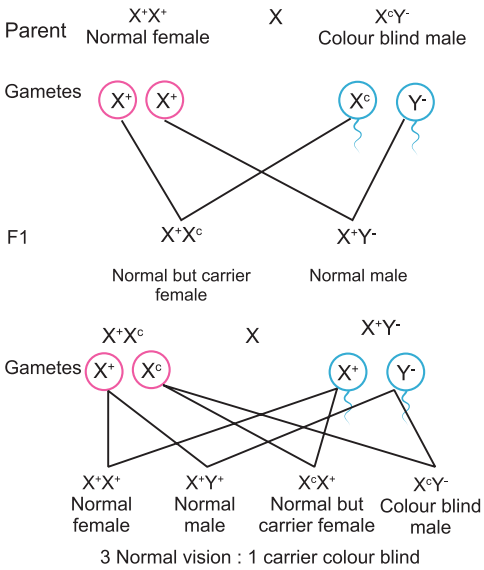
Long Answers — 5 Marks

1. Explain criss-cross pattern of inheritance with an example. (or) Explain Inheritance of colour blindness.

Ans. In human beings a dominant X – linked gene is necessary for the formation of colour sensitive cells, the cones. The recessive form of this gene is incapable of producing colour sensitive cone cells. Homozygous recessive females (X^cX^c) and hemizygous recessive males (X^cY) are unable to distinguish red and green colour. The inheritance of colour blindness can be studied in the following two types of marriages.

(i) **Marriage between colour blind man and normal visioned woman:**

A marriage between a colour blind man and a normal visioned woman will produce normal visioned male and female individuals in F1 generation but the females are carriers. The marriage between a F1 normal visioned carrier woman and a normal visioned male will produce one normal visioned female, one carrier female, one normal visioned male and one colour blind male. Colour blind trait is inherited from the male parent to his grandson through carrier daughter, which is an example of criss-cross pattern of inheritance.

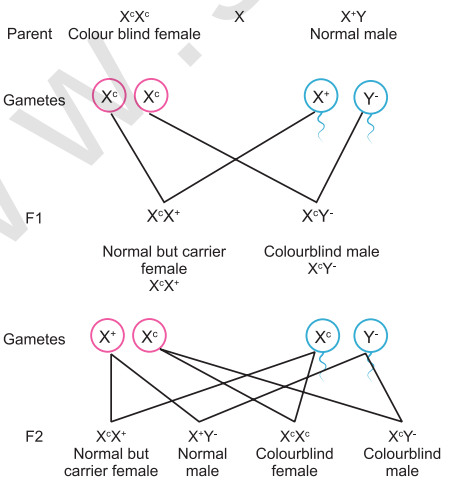


Marriage between colour blind man and normal visioned woman

(ii) **Marriage between normal visioned man and colour blind woman:**

(a) If a colour blind woman (X^cX^c) marries a normal visioned male (X^CY), all F_1 sons will be colourblind and daughters will be normal visioned but are carriers.

(b) Marriage between F_1 carrier female with a colour blind male will produce normal visioned carrier daughter, colourblind daughter, normal visioned son and a colourblind son in the F_2 generation.



Marriage between normal visioned man and colour blind woman

2. Write a note on thalassemia.

Ans. ***(i)*** Thalassemia is an autosomal recessive disorder. It is caused by gene mutation resulting in excessive destruction of RBC's due to the formation of abnormal haemoglobin molecules. Normally haemoglobin is composed of four polypeptide chains, two **alpha** and two **beta** globin chains. Thalassemia patients have defects in either the alpha or beta globin chain causing the production of abnormal haemoglobin molecules resulting in anaemia.

(ii) Thalassemia is classified into alpha and beta based on which chain of haemoglobin molecule is affected. It is controlled by two closely linked genes HBA1 and HBA2 on chromosome 16. Mutation or deletion of one or more of the four alpha gene alleles causes Alpha Thalassemia. In Beta Thalassemia, production of beta globin chain is affected. It is controlled by a single gene (HBB) on chromosome 11. It is the most common type of Thalassemia and is also known as Cooley's anaemia. In this disorder the alpha chain production is increased and damages the membranes of RBC.

3. Write a note on allosomal chromosomal abnormalities.

Ans. Mitotic or meiotic non-disjunction of sex chromosomes causes allosomal abnormalities. Several sex chromosomal abnormalities have been detected. **Eg.** Klinefelter's syndrome and Turner's syndrome.

(i) **Klinefelter's Syndrome (XXY Males)**

This genetic disorder is due to the presence of an additional copy of the X chromosome resulting in a karyotype of 47, XXY. Persons with this syndrome have 47 chromosomes (44AA+XXY). They are usually sterile males, tall, obese, with long limbs, high pitched voice, under developed genitalia and have feeble breast (gynaecomastia) development.

(ii) **Turner's Syndrome (XO Females)**

This genetic disorder is due to the loss of a X chromosome resulting in a karyotype

of 45, X. Persons with this syndrome have 45 chromosomes (44 autosomes and one X chromosome) (44AA+XO) and are sterile females. Low stature, webbed neck, under developed breast, rudimentary gonads lack of menstrual cycle during puberty, are the main symptoms of this syndrome.

4. Discuss the methods adopted for the improvement of human race.

Ans. The methods adopted for the improvement of human beings are

(i) Eugenics
(ii) Euthenics
(iii) Euphenics

Eugenics:

Application of the laws of genetics for the improvement of human race is called eugenics. The term eugenics means "well born" and was coined by Francis Galton in 1885. For the betterment of future generations it is necessary to increase the population of outstanding people and to decrease the population of abnormal and defective people by applying the principles of eugenics.

Two methods of Eugenics

(i) Constructive method or Positive eugenics
(ii) Restrictive method or Negative eugenics

(i) **Positive eugenics:** 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:

(a) Early marriage of those having desirable traits
(b) Subsiding the fit and establishing sperm and egg banks of precious germplasm
(c) Educating the basic principles of genetics and eugenics
(d) Improvement of environmentalconditions
(e) Promotion of genetic research

(ii) **Negative eugenics:** Negative Eugenics attempts to eliminate the defective germplasm of the society by adopting the following measures:

(a) Sexual separation of the defectives
(b) Sterilization of the defectives
(c) Control of immigration and
(d) Regulation of marriages

Euphenics:

The symptomatic treatment of genetic disease of man is called Euphenics or Medical engineering. In 1960, Joshua Lederberg coined the term Euphenics. It means normal appearing. It deals with the control of several inherited human diseases especially the inborn errors of metabolism. Eg. Phenylketonuria (PKU)

Euthenics:

The science of improvement of existing human race by improving the environmental conditions is called euthenics. It can be achieved by subjecting them to better nutrition, better unpolluted ecological conditions, better education and sufficient medical facilities.

5. Write a note on any 2 Mendelian disorders occurring in human beings.

Ans. The Mendelian disorders in human beings are

(a) Thalassemia
(b) Sickle cell anaemia
(c) Huntington chorea
(d) Phenylketonuria
(e) Albinism

Thalassemia:

(i) Thalassemia is an autosomal recessive disorder. It is caused by gene mutation resulting in excessive destruction of RBC's due to the formation of abnormal haemoglobin molecules. Normally haemoglobin is composed of four polypeptide chains, two alpha and two beta globin chains.
(ii) Thalassemia patients have defects in either the alpha or beta globin chain causing the production of abnormal haemoglobin molecules resulting in anaemia.
(iii) Thalassemia is classified into alpha and beta based on which chain of haemoglobin molecule is affected. It is controlled by two

closely linked genes HBA1 and HBA2 on chromosome 16. Mutation or deletion of one or more of the four alpha gene alleles causes Alpha Thalassemia. In Beta Thalassemia, production of beta globin chain is affected. It is controlled by a single gene (HBB) on chromosome 11. It is the most common type of Thalassemia and is also known as Cooley's anaemia. In this disorder the alpha chain production is increased and damages the membranes of RBC.

Huntington's chorea:

(i) It is inherited as an autosomal dominant lethal gene in man.

(ii) It is characterized by involuntary jerking of the body and progressive degeneration of the nervous system, accompanied by gradual mental and physical deterioration.

(iii) The patients with this disease usually die between the age of 35 and 40.

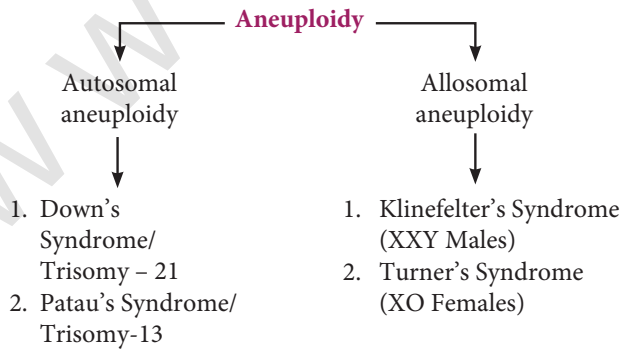
6. Write notes on chromosomal abnormalities in human beings. (or) What is aneuploidy? Explain it.

Ans. In human beings the diploid (2n) body cell has 46 chromosomes (23 pairs).

(i) chromosomal abnormalities are caused by errors is the number or structure of chromosome.

(ii) Failure of chromatids to segregate during cell division resulting in the gain or loss of of one or more choromosomes called aneuploidy. It is caused by the non-disjunction of chromosomes.

(iii) There abnormalities causes various syndromes in human beings. They are



1. Down's Syndrome/Trisomy – 21:

Trisomic condition of chromosome - 21 results in Down's syndrome. It is characterized by severe mental retardation, defective development of the central nervous system, increased separation between the eyes, flattened nose, ears are malformed, mouth is constantly open and the tongue protrudes.

2. Patau's Syndrome/Trisomy-13:

(i) Trisomic condition of chromosome 13 results in Patau's syndrome. Meiotic non disjunction is thought to be the cause for this chromosomal abnormality.

(ii) It is characterized by multiple and severe body malformations as well as profound mental deficiency. Small head with small eyes, cleft palate, malformation of the brain and internal organs are some of the symptoms of this syndrome.

b. Allosomal abnormalities in humanbeings:

Mitotic or meiotic non-disjunction of sex chromosomes causes allosomal abnormalities. Several sex chromosomal abnormalities have been detected. Eg. Klinefelter's syndrome and Turner's syndrome.

1. Klinefelter's Syndrome (XXY Males):

This genetic disorder is due to the presence of an additional copy of the X chromosome resulting in a karyotype of 47, XXY. Persons with this syndrome have 47 chromosomes (44AA+XXY). They are usually sterile males, tall, obese, with long limbs, high pitched voice, under developed genitalia and have feeble breast (gynaecomastia) development.

2. Turner's Syndrome (XO Females):

This genetic disorder is due to the lossof a X chromosome resulting in a karyotype of 45, X. Persons with this syndrome have 45 chromosomes (44 autosomes and one X chromosome) (44AA+XO) and are sterile females. Low stature, webbed neck, under developed breast, rudimentary gonads lack of menstrual cycle during puberty, are the main symptoms of this syndrome.

Unit Test

[Time : 1 hr] [Marks: 25]

I. Choose the Correct Answer. 10 × 1 = 10

1. ZW – ZZ system of sex determination occurs in _____.
(a) Fishes (b) Reptiles
(c) Birds (d) All of these

2. Which of the following phenotypes are possible in offspring from the parental combination A X O?
(a) A and B (b) O only
(c) A only (d) A and O

3. Klinefelters syndrome is characterized by
(a) XYY (b) XO
(c) XXY (d) XXX

4. In gypsy moth we find _____ type of sex determination.
(a)ZW - ZZ (b) ZO - ZZ
(c) XX - XY (d) XX - XO

5. Y – Chromosome was discovered by _____.
(a) stevens (b) Henking
(c) Bertram (d) Sonneborn

6. Red – green colour blindness is also called _____.
(a) daltonism (b) glucoma
(c) myopia (d) presbyopia

7.

1.	Karyotyping	A.	Metaphase
2.	XO females	B.	Barr body
3.	3n female	C.	Aneuploidy
4.	Lyon	D.	Bridges

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

8. Mark the correct answer as
Assertion (A): The Kappa in paramecium appears to be a bacterium
Reason (R): Kappa particles are not dependent on the chromosomal genes.
(a) A and R are true, R is the correct explanation of A
(b) A and R are true, R is not the correct explanation of A
(c) A is true, R is false
(d) Both A and R are false

9. Choose the mismatched pair:
(i) SRY - X Chromosome
(ii) Heterogametic female - XX–XO
(iii) Barr body - Sex Chromatin
(iv) Rh factor - Landsteiner
(a) i and iv (b) ii and iii and iv
(c) ii only (d) i and ii

10. Choose the correct statement:
(i) Y linked genes are transmitted from mother to son.
(ii) People with $I^A I^O$ gene type have O blood group.
(iii) Human Y chromosome is shorter than X chromosome
(iv) Fertilized eggs develop into Drones
(a) i,iv (b) ii,iii,iv
(c) i and iii (d) iii only

II. Very Short Answer 2×2 = 4

11. Define eugenics.

12. What is criss cross inheritance?

III. Short Answer 2×3 = 6

13. List any three applications of karyotype

14. What is trisomy 21?

IV. Long Answer 1×5 = 5

15. Write a note on genetic control of ABO Blood groups.

(OR)

Write a note on Thalassemia

UNIT II

Chapter 5

MOLECULAR GENETICS

CHAPTER SNAPSHOT

NOTES