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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 Bio-Zoology & Zoology** for +2 Standard. 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.

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ZOOLOGY LONG VERSION

(FOR PURE SCIENCE GROUP)

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UNIT I

Chapter 1

REPRODUCTION IN ORGANISMS

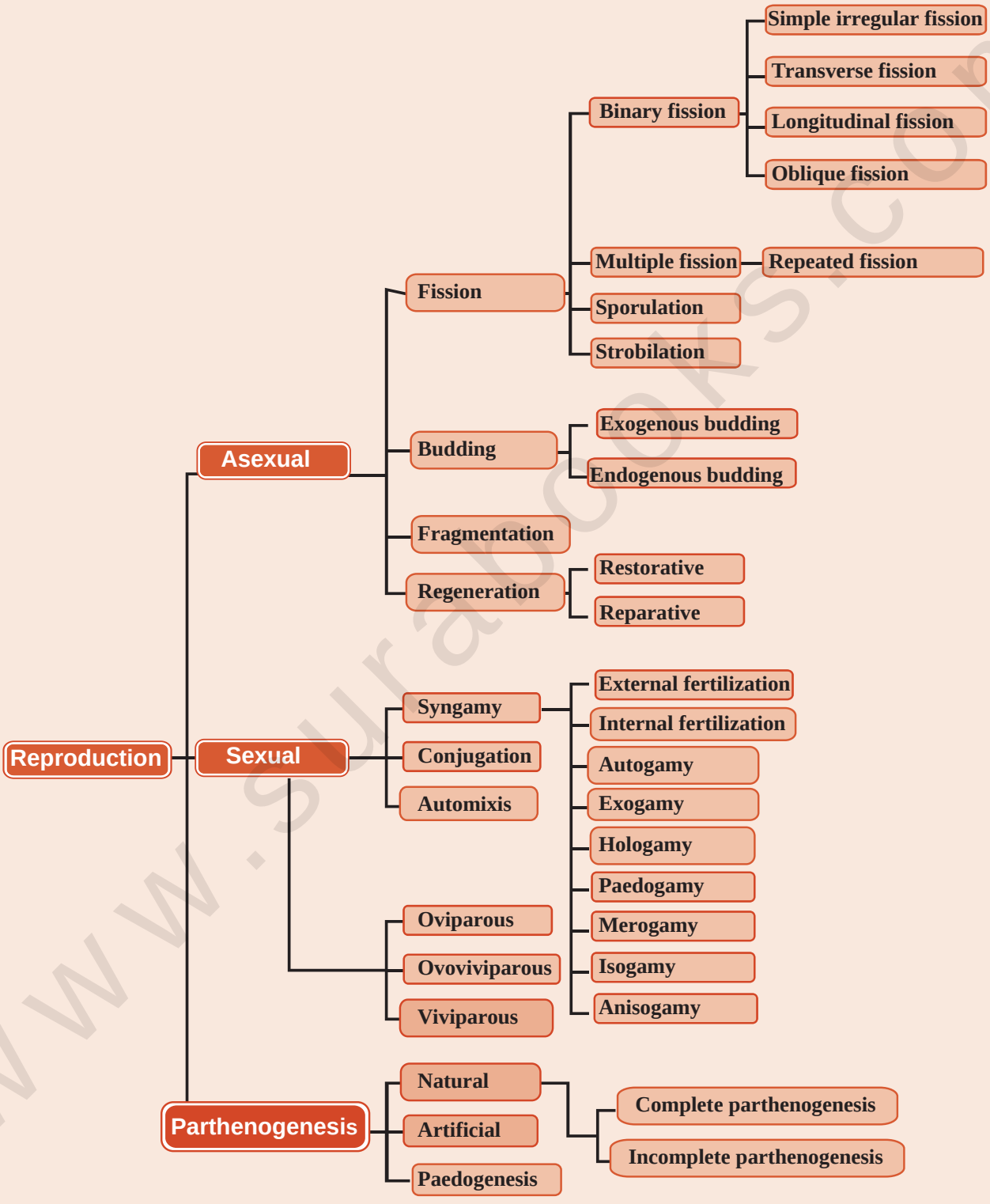
CHAPTER SNAPSHOT

1.1 Modes of reproduction
1.2. Asexual reproduction
1.3. Sexual reproduction

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



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Evaluation

1. In which type of parthenogenesis are only males produced? *[QY-2019]*

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

[Ans. (a) Arrhenotoky]

2. The mode of reproduction in bacteria is by

(a) Formation of gametes
(b) Endospore formation
(c) Conjugation
(d) Zoospore formation **[Ans. (c) Conjugation]**

3. In which mode of reproduction variations are seen

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

[Ans. (c) Sexual]

4. Assertion and reasoning questions:

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

A. If both A and R are true and R is correct explanation for A.
B. If both A and R are true but R is not the correct explanation for A.
C. If A is true but R is false.
D. If both A and R are false.

I. **Assertion:** In bee society, all the members are diploid except drones.
Reason: Drones are produced by parthenogenesis.
A B C D
[Ans. (A) Both A and R are true and R is correct explanation for A]

II. **Assertion:** Offsprings produced by asexual reproduction are genetically identical to the parent.
Reason: Asexual reproduction involves only mitosis and no meiosis.
A B C D
[Ans. (A) Both A and R are true and R is correct explanation for A]

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

Ans. Bacteria, *Amoeba.*

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

Ans. Phenomenon – Parthenogenesis
Eg: Turkey.

7. What is Parthenogenesis? Give two examples from animals. *[QY-2019]*

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.

8. Which type of reproduction is effective -Asexual or sexual and why? (OR) Why sexual method of reproduction is better than asexual reproduction? *[PTA-5]*

Ans. (i) Sexual reproduction produces variation in the offspring, chances of having genes of both the parents whereas in an asexual reproduction, there is no variation, the offspring will be identical to only one of the parent.
(ii) Thus sexual reproduction is said to be more effective than asexual reproduction.

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

Ans. (i) In **binary fission** (asexual reproduction), the single parental organism divides into two halves and each half forms a daughter individual. This is seen in unicellular organism like bacteria, *Amoeba* etc.
(ii) The parent cell does not die but it becomes a part of the daughter cells formed.
(iii) This means that the same organism keeps spliting into new young ones. So there is no way we could say that the organism has died.
(iv) Thus the unicellular organisms which reproduce by binary fission are considered immortal.

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

Ans. (i) Asexual reproduction involves a single parent.
(ii) Offsprings produced by asexual reproduction are morphologically and genetically similar to their parents exact copies of their parents and are called clones.

11. Give reasons for the following: *[Sep. 2020]*

(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.

(i) Natural parthenogenesis occurs in Nature in many animals such as honey bees.

(ii) 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.

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

12. 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*
Simple irregular binary fission is seen in *Amoeba* like irregular shaped organisms.	In *Plasmodium*, multiple fission occurs in the schizont and in the oocyte stages.
Contractile vacuoles cease to function and disappear.	Multiple fission occurs in the schizont is called schizogony and the daughter individuals are called merozoites.
The nucleoli disintegrate and the nucleus divides mitotically. The cell constricts in the middle, so the cytoplasm divides and forms two daughter cells.	Multiple fission occurs in the Oocyte, it is called sporogony and the daughter individuals are called sporozoites.

(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.

13. How is Juvenile phase different from reproductive phase?

Ans.

Juvenile phase	Reproductive phase
Juvenile phase/ vegetative phase is the period of growth between the birth of the individual upto reproductive maturity.	During reproductive phase/ maturity phase the organisms reproduce and their offsprings reach maturity period.

14. What is the difference between syngamy and fertilization?

Ans.

Syngamy	Fertilization
Process of fusion of two gametes to form zygote.	It refers to the act or process of rendering fertile.
Classified into many types • Autogamy • Exogamy • Hologamy • Paedogamy • Merogamy • Isogamy • Anisogamy	Classified into two types of fertilization, • External Fertilization • Internal Fertilization

Zoology Long Version Questions (for pure science Group)

Q.No. 1 to 10 Refer Evaluation.

11. 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.

12. Refer Evaluation Q.No.11

13. Refer Evaluation Q.No.12

14. Refer Evaluation Q.No.13

15. Refer Evaluation Q.No.14

Important Question & Answers

1. Animals giving birth to young ones:

(a) Oviparous
(b) Ovivіviparous
(c) Viviparous
(d) Both a and b **[*Ans.* (c) Viviparous]**

PTA Question & Answers

Choose the Correct Answer — 1 Mark

1. Human beings are unisexual animals, the type of syngamy in human beings is *[PTA-3]*

(a) autogamy (b) exogamy
(c) hologamy (d) paedogamy
[*Ans.* (a) autogamy]

2. In hydra, the buds develop from *[PTA-4]*

(a) ectoderm layer only
(b) ectoderm and endoderm layers
(c) ectoderm, mesoderm and endoderm layers
(d) ectoderm and mesoderm layers
[*Ans.* (b) ectoderm and endoderm layers]

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

(a) Mosquito and man
(b) Man and housefly
(c) Cattle and man
(d) Man and pig **[*Ans.* (d) Man and pig]**

Very Short Answers — 2 Marks

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

Ans. **(i)** *Paramecium* reproduces both sexually and asexually.

(ii) In *Paramecium*, conjugation is a form of sexual reproduction. It is a temporary union of two individuals of same species for mutual exchanges of genetic materials.

(iii) If can also multiply during nuclear organizations.

Various process of *Paramecium* reproduction listed below:

(i) Binary fission - Asexual reproduction.

(ii) Conjugation - Sexual reproduction by cross fertiliztion.

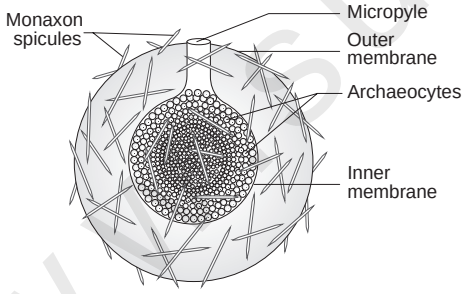
2. Why do we call parthenogenesis as a special type of sexual reproduction in animals? *[PTA-4]*

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

(ii) Parthenogenesis is the special type of sexual reproduction seen in animals. It is of two main types namely natural parthenogenesis and artificial parthenogenesis.

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

Ans.



Gemmule in sponges

Short Answers — 3 Marks

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

Ans. **(i)** Drones are produced by parthenogenesis, unfertilized eggs develop into drone bees (males).

(ii) Males have the half the number of chromosomes (haploid). Thus meiosis cell division does not take place during the gametes formation of drone bees.

2. Write the differences between multiple fission and sporulation in *Amoeba*. *[PTA-6]*

Ans.

	Multiple fission	Sporulation
1.	The parent body divides into many similar daughter cells simultaneously.	During unfavourable conditions *Amoeba* multiplies by sporulation without encystment.
2.	Nucleus divides repeatedly without the division of the cytoplasm, later the cytoplasm divides into many parts as that of nuclei.	Nucleus breaks into several small fragments or chromatin blocks.

GOVERNMENT EXAM QUESTIONS

Bio-Zoology (Short version)

Choose the Correct Answer — 1 Mark

1. Which among the following animals exhibit ovoviviparity? *[Govt.MQP-2019]*

(a) frog (b) shark
(c) sheep (d) hen

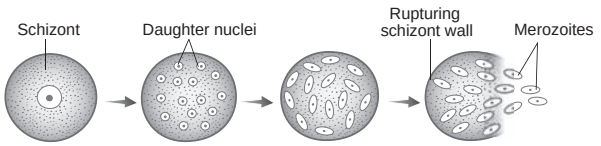
[Ans. (b) shark]

Short Answers — 3 Marks

1. Explain multiple fission in *Plasmodium* with a diagram. *[Govt.MQP-2019]*

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**.



Multiple Fission in *Plasmodium*

Zoology (Long version)

Choose the Correct Answer — 1 Mark

1. Paedogenetic Parthenogenesis occurs in : *[Mar-2020]*

(a) Aphis (b) Honey bees
(c) Solenobia (d) Gall fly

[Ans. (d) Gall fly]

2. Which one of the following is true regarding binary fission in Paramecium? *[Sep. 2020]*

(a) Macronucleus divides by mitosis and the micronucleus divides by amitosis.
(b) Macronucleus divides by amitosis and the micronucleus divides by mitosis.
(c) Macronucleus and micronucleus divide by amitosis.
(d) Micronucleus and macronucleus divide by mitosis.

[Ans. (b) Macronucleus divides by amitosis and the micronucleus divides by mitosis.]

Short Answers — 3 Marks

1. Write a note on regeneration. *[Mar-2020]*

Ans. Regeneration is regrowth in the injured region. Regeneration was first studied in *Hydra* by Abraham Trembley in 1740. Regeneration is of two types, ***(i)* morphallaxis** and ***(ii)* epimorphosis**.

(i) **Morphallaxis:** The whole body grows from a small fragment. **E.g.** *Hydra* and *Planaria*.

(a) When *Hydra* is accidentally cut into several pieces, each piece can regenerate the lost parts and develop into a whole new individual.

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

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

(a) **Reparative regeneration:** Only certain damaged tissue can be regenerated.

(b) **Restorative regeneration:** Several body parts can develop. **E.g.** star fish, tail of wall lizard.

Additional Questions

Choose the Correct Answer — 1 Mark

I. Choose the Correct options for the below Questions

1. Transverse Binary fission is seen in ____

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

[Ans. (b) *Paramecium*]

2. In dinoflagellates, the type of asexual reproduction is _____

(a) Simple irregular 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 in _____
(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 is seen in *Planaria.*
(b) Longitudinal binary fission is seen in *Euglena.*
(c) Oblique binary fission is seen in *flagellates* .
(d) Simple binary fission is seen in *Amoeba.*
[Ans. (c) Oblique by fission is 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 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 produce _____ .**
(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 irregular 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 shows ____ 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. **In _____ types of natural parthenogenesis, only females are produced.**

(a) Thelytoky (b) Arrhenotoky
(c) paedogenesis (d) Amphitoky

[Ans. (a) Thelytoky]

14. **In _____ types of parthenogenesis, egg can develop into individuals of any sex.**

(a) Thelytoky (b) paedogenesis
(c) Amphitoky (d) Arrhenotoky

[Ans. (c) Amphitoky]

15. **_____ 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 in shark
Reason : Placenta is formed to transfer nutrients to the embryo.

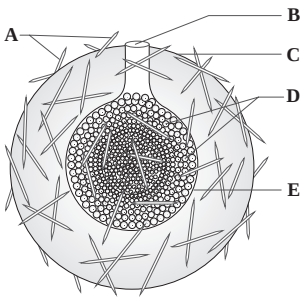
[Ans. (C) A is true but R is false]

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.



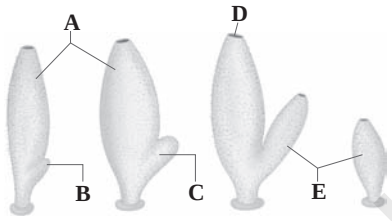
Identify the correct option to label the diagram

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.



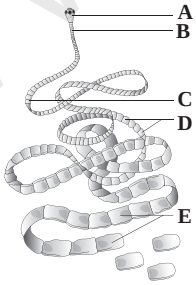
Identify the correct option to label the diagram.

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.

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 mature 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]**

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. What is known as Paedogamy? *[QY-2019]*

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

2. Name the types of fission.

Ans. There are five types of fission. They are: Binary fission, multiple fission *plasmotomy*, sporulation, and strobilation.

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

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

4. What is Plasmotomy?

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

* Only for quick revision, not in pattern

(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.

5. 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.*

6. Define regeneration. Mention the types.

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

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

7. What is Morphallaxis?

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

8. What is Epimorphosis?

Ans. It is type of regeneration which involves replacement of the lost body parts. It is of two types.

(i) **Reparative regeneration** – Only certain damaged tissue can be regenerated.

(ii) **Restorative regeneration** – Several body parts can develop. **E.g.** Star fish.

9. What is Syngamy?

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

10. What is Autogamy?

Ans. It is a type of fertilization. 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.*

11. What is Exogamy?

Ans. It is a type of fertilization. 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.

12. 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.*

13. What is Merogamy?

Ans. It is a type of fertilization. The fusion of small sized and morphologically different gametes (merogametes) takes place.

14. Define Isogamy.

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

15. 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.*

16. How are animals classified based on breeding periods?

Ans. On the basis of time, breeding animals are of two types: Seasonal breeders and continuous breeders.

(i) **Seasonal breeders:** Reproduce at particular period of the year. **E.g:** Frogs, lizards, most birds, deers etc.,

(ii) **Continuous breeders:** Continue to breed throughout their sexual maturity. **E.g.** honey bees, poultry, rabbit etc.

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

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

18. 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.

19. 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.

20. Name the types of natural parthenogenesis.

Ans. (i) Arrhenotoky – e.g. Honey bees

(ii) Thelytoky – e.g. Solenobia

(iii) Amphitoky – e.g. *Aphis.*

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

Ans. Budding and Regeneration.

22. Mention the types of asexual reproduction seen in *Amoeba*.

Ans. *(i)* Binary fission

(ii) Encystment and spore formation – unfavourable conditions

(iii) Sporulation - unfavourable conditions

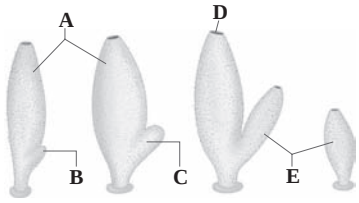
23. Name the stages of multiple fission in *Plasmodium*.

Ans. In *Plasmodium*, multiple fission occurs in the schizont and oocyte stages.

24. Mention the different modes of asexual reproduction.

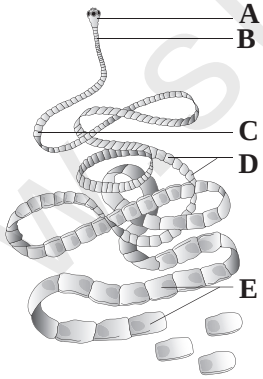
Ans. The different modes of asexual reproduction seen in animals are fission, sporulation, budding, gemmule formation, fragmentation and regeneration.

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



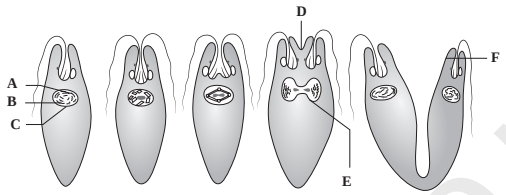
Ans. A – Individual parent
B – Bud forming
C – Bud growing
D – Osculum
D – Daughter individual

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 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.

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4. What is Strobilation?

Ans. **(i)** A special type of transverse fission occurs in some metazoan animals are called **strobilation**.

(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*.

5. 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*

6. 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).

7. 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.

8. 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

9. 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.

10. 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.

11. 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

12. 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. **Eg:** Ovoviviparity is seen in fishes like shark.

13. 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.

14. 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.

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

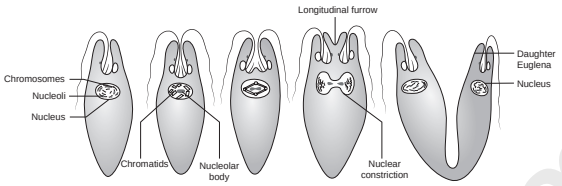
Ans. Organisms have three phases in its life cycle.

(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.

16.



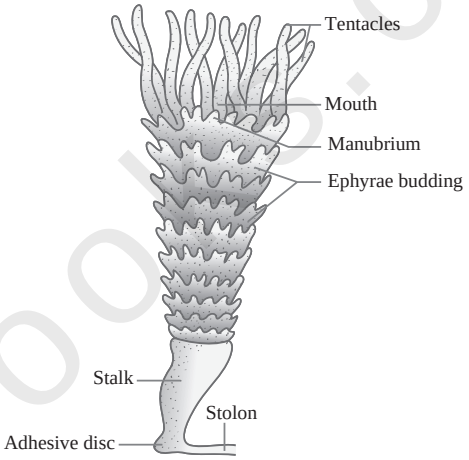
(i) Identify the Process.

(ii) Name the Organism.

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

(ii) *Euglena*

17.



(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. 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 (1) Natural Parthenogenesis and (2) Artificial Parthenogenesis. 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:** Only males are produced by parthenogenesis. **E.g:** honey bees

b) **Thelytoky :** Only females are produced by parthenogenesis. **E.g:** Solenobia

c) **Amphitoky :** Parthenogenetic egg may develop into individuals of any sex. **E.g:** *Aphis*.

Natural parthenogenesis may be of two types, viz., complete and incomplete.

(i) **Complete parthenogenesis:** There is no biparental sexual reproduction. There are no male organisms and so, such individuals are represented by females only.

(ii) **Incomplete parthenogenesis:** 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).

(iii) **Paedogenetic parthenogenesis (paedogenesis):** The larvae produce a new generation of larvae by parthenogenesis. 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.

(iv) **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.

2. 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

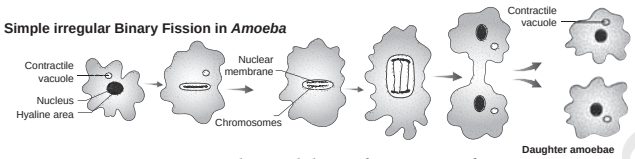
(i) Simple irregular binary fission

(ii) Transverse binary fission

(iii) Longitudinal binary fission

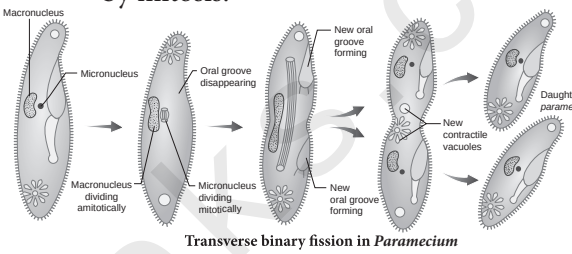
(iv) Oblique binary fission

(v) **Simple irregular binary fission:** It 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 constricts in the middle, so the cytoplasm divides and forms two daughter cells.



Irregular simple binary fission in *Amoeba*

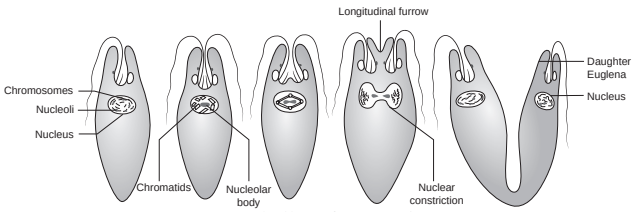
(vi) **Transverse binary fission:** The plane of the division runs along the transverse axis of the individual. **E.g.** *Paramecium* and *Planaria*. In *Paramecium* the macronucleus divides by amitosis and the micronucleus divides by mitosis.



Transverse binary fission in *Paramecium*

(vii) **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*.

(viii) **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 can be fertilized by any of the sperms. Hence variations will occur and degree of variations cannot be predicted in sexual reproduction.

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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 : Placenta 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 is seen in *Planaria*.
(b) Longitudinal binary fission is seen in *Euglena*.
(c) Oblique binary fission is seen in *Flagellates*.
(d) Simple iregular binary fission is 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.

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