



**पुर्णिमा International School**  
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***BIOLOGY -XII***

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## Chapter 1 REPRODUCTION IN ORGANISMS

The period between birth and natural death of an organism is called its lifespan. It can vary from less than a day to more than 400 yrs.

Whatever be the lifespan, death of every individual organism is a certainty,

### Reproduction:

1. The period between birth and natural death of an organism is called its lifespan. It can vary from less than a day to more than 400 yrs.

Whatever be the lifespan, death of every individual organism is a certainty,

i. e. no individual is immortal, except single-celled organisms.

Lifespan of some organisms are given in the following table:

Living organism	Lifespan
Mayfly	1 day
Butterfly	1-2 weeks
Wheat plant	6 months
Crow	15 yrs
Dog	25 yrs
Banana tree	25 yrs
Human	100 yrs
Parrot	140 yrs
Banyan tree	200 yrs

**2. Reproduction** is a biological process of continuity of a race in which the grown up individuals give rise to off springs similar to them.

It performs the following functions:

- (i) Enables continuity of the species.
- (ii) Maintains life on the earth.
- (iii) Creates variations among population.

The mechanism to produce offsprings shows large variations, depending on organisms habitat, its internal physiology and several other factors.

Based on the participation of one or two organisms, reproduction can be of following two types:

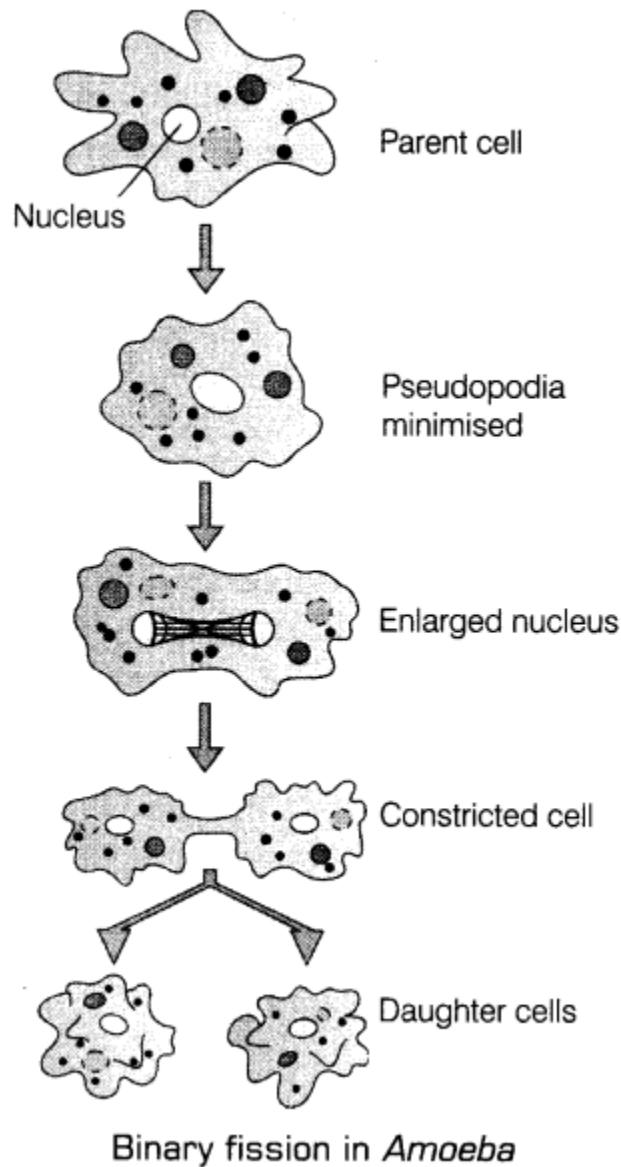
- (i) Asexual reproduction
- (ii) Sexual reproduction

**3. Asexual reproduction** A single parent is capable of producing offsprings. Thus, the offsprings are genetically and morphologically identical to one another and to their parent. These are often referred to as clone. The unit of reproduction is commonly formed from the

somatic cells of the parent. Meiosis does not occur in asexual reproduction.

Asexual reproduction is common among single-celled organisms and in plants and animals with simple organisations. Cell division in itself is a mode of reproduction in protists, e.g. bacteria and monerans, e.g. Amoeba (the parent cell divide into two to give rise to new individuals).

Types of asexual reproduction are as given below:



### I. Fission can be further classified as:

**(i) Binary fission** The body of an individual divides into two equal halves.

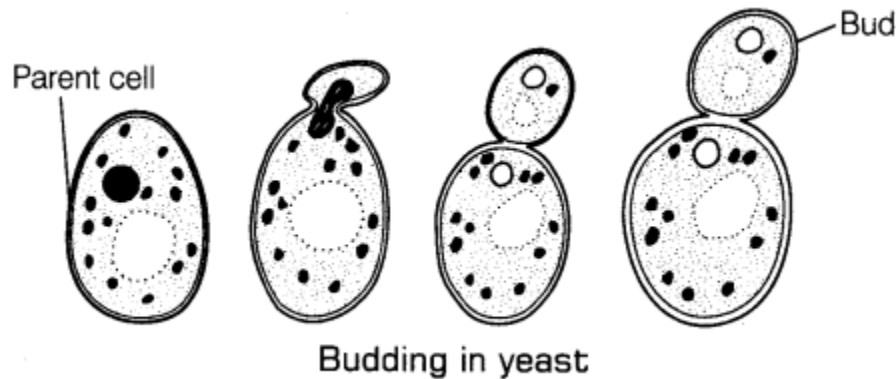
It can be following types:

(a) **Simple binary fission** When division occurs in any plane but it is always right angle to the elongated dividing nucleus, e.g. Amoeba.

(b) **Longitudinal binary fission** When division occurs along the longitudinal axis, e.g. Euglena, Vorticella.

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**II. Budding**, (torulation) an outgrowth or bud develops, grows, constricts at the base and separates from the parent body, e.g. yeast and Hydra. The complex budded condition is called torula stage.

**III. Sporulation** occurs by tiny, single-celled, thin-walled spores that are extremely resistant to environmental extremes. The spores form new individuals. It commonly occurs in Monera, Protista, Fungi and Algae.

Spores formed can be of following main types:

- |   |  |
|---|--|
| (i) Pseudopodio spore (with fine pseudopodia) | – <i>Amoeba</i>                            |
| (ii) Zoospores (motile with flagellated)      | – <i>Chlamydomonas</i> and <i>Ulothrix</i> |
| (iii) Conidia (non-motile)                    | – <i>Penicillium</i>                       |
| (iv) Sporangiospores (non-motile)             | – <i>Rhizopus</i>                          |
| (v) Gemmules (internal buds)                  | – Sponges                                  |

**IV. Fragmentation** occurs by breaking of the parent body into two or more parts, each of which grows to form an independent individual, e.g. algae like Spirogyra and bryophytes such as Marchantia, Riccia.

**V. Regeneration** is a type of asexual reproduction in which the missing part of the organism is repaired by the proliferation of cells, e.g. Hydra, planaria and sponges.

**VI. Vegetative propagation** is the formation of a new plants from vegetative parts like root, stem, leaf, etc., naturally, e.g. water hyacinth (scourage of the water bodies or Terror of Bengal) propagates very quickly by vegetative mode and drains out dissolved O<sub>2</sub> from water bodies. Some artificial methods of vegetative propagation are also developed by the farmers like cutting, layering, grafting, etc.

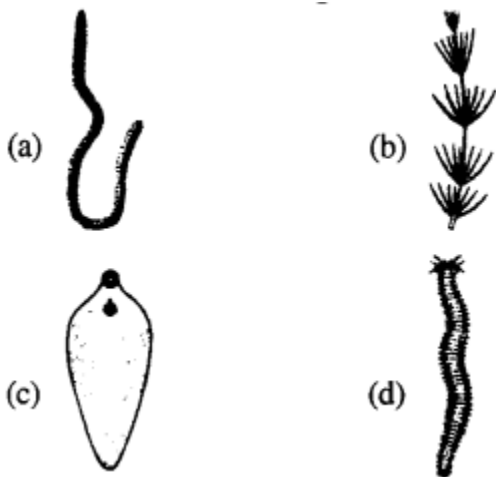
Some examples of natural method of vegetative propagation are:

Vegetative part	Example
Roots	<i>Dahlia, Asparagus, Dalbergia, guava and tapioca</i>
Stems	
• Tubers	Potato and artichoke
• Bulbs	Garlic and onion
• Rhizome	Ginger, turmeric, banana and <i>Dryopteris</i>
• Corms	<i>Colocasia, Crocus and Amorphophallus</i>
• Suckers	Mint and <i>Chrysanthemum</i>
• Runners	<i>Oxalis and Centella</i>
• Stolons	Jasmine
• Offsets	<i>Pistia and Eichhornia</i>
Leaves	<i>Bryophyllum, Begonia, Kalanchoe</i> and walking fern
Bulbils	Agave, lily and <i>Dioscorea</i>
Turions (fleshy buds in aquatic plants)	<i>Potamogeton and Utricularia</i>

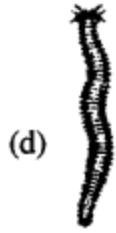
The units of vegetative propagation such as runner, rhizome, sucker, tuber, offset, bulb all have capability to give rise to new off springs. These structures are known as vegetative propagules.

### Multiple choice question

1 Which of the following is a unisexual organism?



Answer



Question 2.

Which of the following groups is formed only of the hermaphrodite organisms?

- (a) Earthworm, tapeworm, housefly, frog
- (b) Earthworm, tapeworm, sea horse, housefly
- (c) Earthworm, leech, sponge, roundworm
- (d) Earthworm, tapeworm, leech, sponge

Answer:

- (d) Earthworm, tapeworm, leech, sponge

Question 3.

Which of the following options shows bisexual animals only?

- (a) Amoeba, sponge, leech
- (b) Sponge, cockroach, Amoeba
- (c) Earthworm, sponge, leech
- (d) Tapeworm, earthworm, honeybee

Answer:

- (c) Earthworm, sponge, leech

Question 4.

Read the following statements and select the incorrect one.

- (a) Cucurbits and coconuts are monoecious plants.
- (b) Papayas and date palms are dioecious plants.
- (c) Leeches and tapeworms are bisexual animals.
- (d) Sponges and coelenterates are unisexual animals.

Answer:

- (d) Sponges and coelenterates are unisexual animals

Question 5.

Meiosis does not occur in

- (a) asexually reproducing diploid individuals
- (b) sexually reproducing haploid individuals
- (c) sexually reproducing diploid individuals
- (d) all of these.

Answer:

- (a) asexually reproducing diploid individuals

Question 6.

A diploid parent plant body produces \_\_\_\_\_ gametes and a haploid parent plant body

produces \_\_\_\_\_ gametes.

- (a) diploid, haploid
- (b) haploid, diploid
- (c) diploid, diploid
- (d) haploid, haploid

Answer:

Question 7.

Which of the following organisms has the highest number of chromosomes?

- (a) Housefly
- (b) Butterfly
- (c) Ophioglossum
- (d) Onion

Answer:

- (c) Ophioglossum (d) haploid, haploid

Question 8.

In maize, a meiocyte has 20 chromosomes. What will be the number of chromosomes in its somatic cell?

- (a) 40
- (b) 30
- (c) 20
- (d) 10

Answer:

- (c) 20

Question 9.

If a butterfly has chromosome number 360 in its meiocyte ( $2n$ ). What will be the chromosome number in its gametes?

- (a) 380
- (b) 190
- (c) 95
- (d) 760

Answer:

- (b) 190

Question 10.

In flowering plants, both male and female gametes are non-motile. The method to bring them together for fertilisation is

- (a) water
- (b) air
- (c) pollination
- (d) apomixis

Answer:

- (c) pollination



Question 11.

In which of the following plants, sepals do not fall off after fertilisation and remain attached to the fruit?

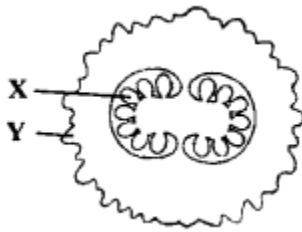
- (a) Brinjal
- (b) Cucumber
- (c) Papaya
- (d) Bitter gourd

Answer:

- (a) Brinjal

Question 12.

Which of the labelled parts in the transverse section of tomato fruit, is/are diploid?



- (a) X
- (b) Y
- (c) Both X and Y
- (d) None of these

Answer:

- (c) Both X and Y

Question 13.

The wall of the ovary forms

- (a) pericarp
- (b) fruit wall
- (c) fruit
- (d) both (a) and (b).

Answer:

- (d) both (a) and (b).

Question 14.

The term 'clone' cannot be applied to offspring formed by sexual reproduction because

- (a) offspring do not possess exact copies of parental DNA
- (b) DNA of only one parent is copied and passed on to the offspring
- (c) offspring are formed at different times
- (d) DNA of parent and offspring are completely different

Answer:

- (a) offspring do not possess exact copies of parental DNA

Question 15.

The male gametes of rice plant have 12 chromosomes in their nucleus. The chromosome number in the female gamete, zygote and the cells of the seedling will be, respectively

- (a) 12,24,12
- (b) 24,12,12
- (c) 12, 24, 24
- (d) 24, 12, 24.

Answer:

- (c) 12, 24, 24

## Question Answers

### 1. Why is reproduction essential for organisms?

**Ans:** Reproduction is the ability of living organisms to produce a young one similar to itself. It ensures continuity of a species generation after generation. Reproduction introduces variation in the organisms. Useful variations are essential for adaptation and evolution. Therefore, it is essential for organisms.

### 2. Which is a better mode of reproduction sexual or asexual? Why?

**Ans:** Sexual reproduction is a better mode of reproduction because of the following reasons:

1. Variation : Since fusion of gametes from different parents occur during sexual reproduction, hence genetic recombination takes place causing variations.
2. Evolution : Variation being a major factor of natural selection, therefore, it plays an important role in evolution.
3. Adaptation : The offspring produced due to sexual reproduction adapt better to the changing environmental conditions.
4. Vigour and Vitality : Genetic recombination, interaction, etc. during sexual reproduction provide vigour and vitality to the offspring.

### 3. Why is the offspring formed by asexual reproduction referred to as clone?

**Ans:** Asexual reproduction is a type of reproduction in which a single individual is capable of producing offspring. These offspring are not only genetically and morphologically similar to one another but also similar to their parent. Clone is the term given to individuals that are genetically and morphologically similar. Thus the offspring produced by asexual reproduction are called clones.

### 4. Offsprings formed due to sexual reproduction have better chances of survival. Why? Is this statement always true?

**Ans:** The offsprings obtained from sexual reproduction have better chances of survival because the genetic material of such organisms are formed from both the parents. Daughter organisms/offsprings show variation that leads to the evolution of species.

This statement is always true. The offspring produced due to sexual reproduction adapt better to the changing environmental conditions. Genetic recombination, interaction, etc. during sexual reproduction provide vigour and vitality to the offspring.

**5. How does the progeny formed from asexual reproduction differ from those formed by sexual reproduction?**

**Ans:** Production of offspring by a single parent without the formation and fusion of gametes is called asexual reproduction. It involves only mitotic cell division that gives rise to daughter cells which are genetically identical to the parent cell. Sexual reproduction is the production of offspring by two parents, male and female. It involves meiotic cell divisions producing haploid nuclei which on fusion produce offspring that are genetically different from their parents.

**6. Distinguish between asexual and sexual reproduction. Why is vegetative reproduction also considered as a type of asexual reproduction?**

**Ans:** The difference between asexual and sexual reproduction are as follows

	<b>Asexual reproduction</b>	<b>Sexual reproduction</b>
1	It occurs only in invertebrates and lower chordates.	It occurs almost in all types of animals.
2	It is always uniparental.	It is usually biparental.
3	Gametes are not formed.	Two types of gametes are formed.
4	It involves only mitosis.	It involves both meiosis and mitosis.
5	Daughter organisms are genetically identical to the parent.	Daughter organisms genetically differ from their parents.
6	Since there is no variation, so it does not contribute to evolution of the species.	Because of variations, it contributes to the evolution of species.

In plants asexual reproduction is called vegetative reproduction because vegetative plant parts like rhizome, runner, sucker, tuber, bulb all are capable of producing offsprings. These parts give rise to daughter individuals without the involvement of two parents.

**7. What is vegetative propagation? Give two suitable examples.**

**Ans:** Vegetative propagation is the formation of new plants from vegetative units. In plants, the units of vegetative propagation are runner, rhizome, sucker, tuber, offset, bulb, etc. These are capable of producing new offsprings. These structures are called vegetative propagules.

Modified tuberous roots of sweet potato, tapioca, yam, Dahlia and Tinospora can be propagated vegetatively when planted in soil. Small plants emerging from the buds (called eyes) of the potato tuber, from the rhizomes of banana and ginger are other examples.

## 8. Define:

**a) Juvenile phase**

**(b) Reproductive phase**

**(c) Senescent phase.**

**Ans: (a) Juvenile phase :** All organisms have to reach a certain stage of growth and maturity in their life before they can reproduce sexually. That period of growth is called juvenile phase. However, this phase is known as vegetative phase in plants. This phase is of different durations in different organisms.

**(b) Reproductive phase:** The end of juvenile/ vegetative phase marks the beginning of reproductive phase. During this phase, the organisms produce offspring. In higher plants, this phase can be easily seen when they come to flower but in animals, the juvenile phase is followed by morphological and physiological changes prior to active reproductive behaviour. The reproductive phase is also of variable period in different organisms like some plants, flower throughout the year while others show seasonal flowering. In animals like birds lay eggs seasonally “but when in captivity (as in poultry farms) can be made to lay eggs throughout the year. Placental female mammals, undergo cyclical changes in reproductive

**c) Senescent phase:** It begins from the end of the reproductive phase. During this phase of life span, there is progressive deterioration in the body (like slowing of metabolism, etc.). Old age ultimately leads to death. organs during this phase.

## 9. Higher organisms have resorted to sexual reproduction in spite of its complexity. Why?

**Ans:** Higher organisms have resorted to sexual reproduction in spite of its complexity because sexual reproduction results in multiplication and perpetuation of species and also contributes to evolution of species by introducing variation much more faster than asexual reproduction in a particular population. Sexual reproduction enables higher organisms to survive during unfavourable conditions.

## 10. Explain why meiosis and gametogenesis are always interlinked?

**Ans:** Gametogenesis is the process of formation of two types of haploid gametes (male and female). In gametogenesis, gametes are haploid in number and formed by meiosis so the chromosome number is haploid. Thus gametogenesis is always linked with meiosis.

## 11. Identify each part in a flowering plant and write whether it is haploid (n) or diploid (2n).

- (a)Ovary \_\_\_\_\_  
 (b)Anther \_\_\_\_\_  
 (c)Egg \_\_\_\_\_  
 (d)Pollen \_\_\_\_\_  
 (e)Male gamete \_\_\_\_\_  
 (f)Zygote \_\_\_\_\_

**Ans:** (a)2n (b)2n (c)n (d)n (e)n (f)2n

**2. Define external fertilization. Mention its disadvantages.**

**Ans:** When fusion of the gametes takes place outside the body of the organisms, it is called external fertilization or external syngamy. The external medium like water is required for this form of fertilization. This form, is found in many aquatic animals like fishes, amphibians, majority of algae.

In this, parents release eggs and sperms in the surrounding water, then fertilization and development of offspring occur externally. Disadvantages of external fertilization:

- (i)if occurs only in aquatic medium.
- (ii)A chance factor is involved requiring synchronous release of gametes nearby and absence of turbulence of water.
- (iii)There is no protection to young ones. They are vulnerable to a number of predators.

**13. Differentiate between a zoospore and a zygote.**

**Ans:** The zoospore is flagellated, motile, haploid or diploid spore formed inside a zoosporangium. It is the result of asexual reproduction.

The zygote is always diploid and formed by the fusion of gametes. It is usually non-flagellated and non-motile or motile. It is the net result of sexual reproduction.

**14. Differentiate between gametogenesis from embryogenesis.**

**Ans:** Differences between gametogenesis and embryogenesis are as follows :

	<b>Gametogenesis</b>		<b>Embryogenesis</b>
1	It is the formation of male and female gametes.	1	It is the formation of embryo from the zygote.
2	Gametes are the haploid cells.	2	Embryo is a diploid cell.
3	Both mitotic & meiotic cell division take place.	3	Only mitotic division occur.

### 15. Describe the post-fertilization changes in a flower.

**Ans:** In sexual reproduction, events that occur after the formation of zygote are called post-fertilization events. In flowering plants, the zygote is formed inside the ovule. After fertilization the sepals, petals and stamens of the flower wither and fall off. But the pistil remains attached to the plant. The zygote develops into the embryo and the ovules develop into the seed. The ovary develops into the fruit that develops a thick wall called pericarp which is protective in – function. After dispersal, seeds germinate under favourable conditions to produce new plants.

## Chapter 2 Sexual reproduction in Flowering plants

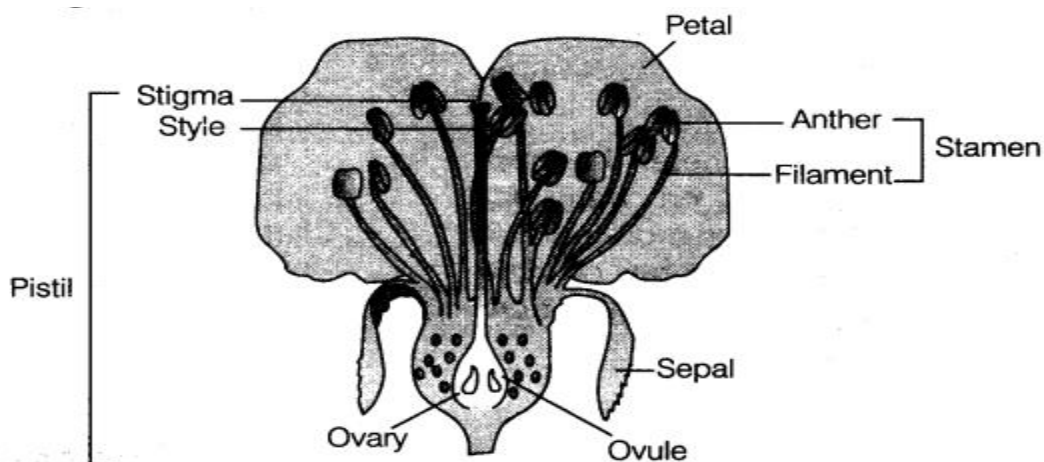
Sexual reproduction is the process of fusion of haploid gametes, resulting in the production of a diploid zygote, which ultimately develops into a new organism. All flowering plants show sexual reproduction.

**1. Flowers** are the site of sexual reproduction in flowering plants.

(i) A flower has following parts arranged in four whorls, i.e. calyx (sepals), corolla (petals), androecium and gynoecium. These are attached to central axis called thalamus.

(ii) Flowers may contain both male (stamens) and female (carpels or pistils) reproductive parts or organs in it and is called bisexual.

(iii) In unisexual flowers, only either of the reproductive parts are present, e.g. corn, the tassels represent the male flowers (stamens) and the ears or silk represent the female flower (styles and stigma).



Diagrammatic representation of LS of a flower

**2. Stamen** is the male reproductive unit of angiosperm.

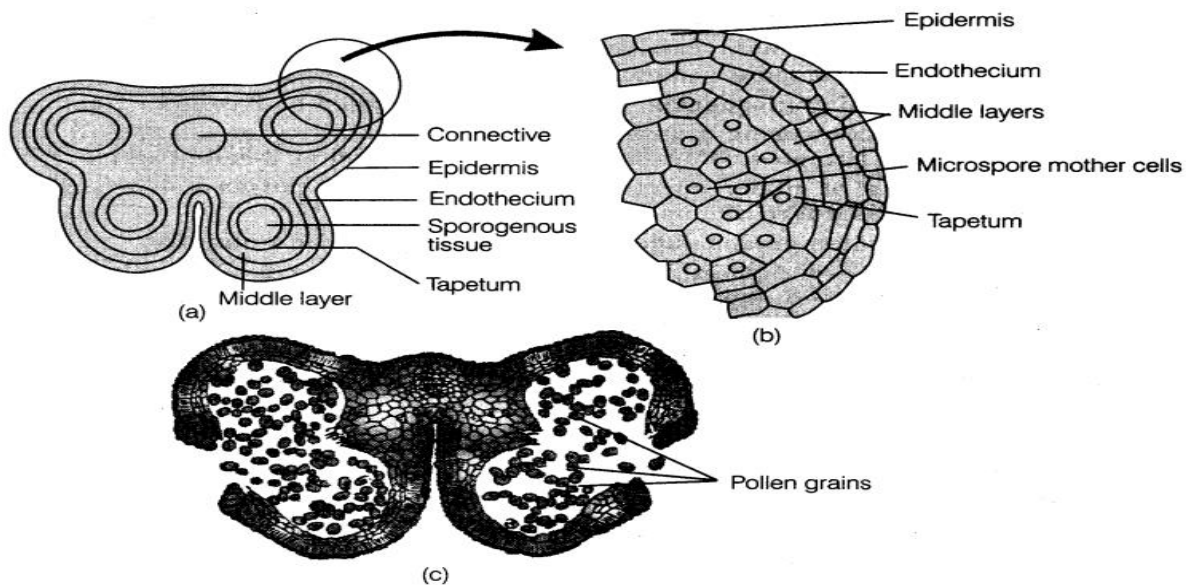
It consists of the following two parts:

- (i) The long and slender stalk called the filament.
- (ii) The terminal generally bilobed structure called the anther.

**.3 Anther** is a bilobed structure with each lobe having two theca, therefore called dithecous. In a cross section, it is a four sided (tetragonal) structure consisting of four microsporangia, located at the corners, two in each lobe. Microsporangia develop and becomes pollen sacs. Pollen sacs contain pollen grains.

Structure of microsporangium contains following features in a transverse section:

- (i) Appears nearly circular in outline.
- (ii) It is surrounded by four wall layers. The outer three layers are epidermis, endothecium and middle layers. Outer three wall layers are protective in function and help in dehiscence of anther to release the pollen. The fourth and innermost layer called the tapetum nourishes developing pollen grains. It contains cells with dense cytoplasm and more than one nuclei.
- iii) A sporogenous tissue occupies the centre of each microsporangium in a young anther.
- (iv) Each cell of sporogenous tissue undergo meiosis to form microspore tetrads. Each cell of the tetrad is known as microspore mother cell.



(a) TS of a young anther (b) Enlarged view of one microsporangium showing four wall layers (c) A mature dehiscing anther

**4. Microsporogenesis** The formation of microspores from a pollen mother cell (each cell of sporogenous tissue) through meiosis is called microsporogenesis.

- (i) Microspores are arranged as tetrad. As the anther matures and dehydrates they dissociate from each other and develop into pollen grains. Pollen grains or the male gametophytes are released by dehiscence of anther.

ii) Pollen grains have the following characteristic features:

- Generally spherical, about 25-50 micrometers in diameter.
- Mature pollen grain comprises of two layers.

(a) Outer hard layer Exine made up of one of the most resistant organic material sporopollenin, that enables them to resist high temperatures and action of strong acids and alkali. Further no enzyme is yet known to degrade sporopollenin, because of which they are well preserved as fossils.

The region on exine where sporopollenin is absent are called germ pores. It helps in the formation of pollen tube, while the pollen grain germinates on stigma.

(b) Inner thin, continuous layer Intine made up of cellulose and pectin.

- A mature pollen grain contains two cells.

(a) Vegetative cell or tube cell It is larger as compared to other cell and possess vacuolated cytoplasm which is rich in reserve food, i.e. starch, protein, fat and cell organelles. The nucleus is large and irregular.

(b) Generative cell It is smaller cell usually spindle-shaped or spherical with thin dense cytoplasm and prominent nuclei. It divides mitotically to form two non-motile male gametes, prior to release of pollen grain

(iii) In about 60% of angiosperms, pollen grains are shed at 2-celled stage.

(iv) In about 40% flowering plants, the generative cell divides mitotically to give rise to the two male gametes before pollen grains are shed at 3-celled stage.

(v) Pollen grains of many species (e.g. Parthenium) causes severe allergic, chronic respiratory disorders like asthma, bronchitis, etc.

(vi) Viability of pollen grains depends on temperature and humidity.

(vii) Pollen grains are richer in nutrients and are used as food supplements in form of pollen tablets and syrups. Its consumption has been claimed to increase the performance of athletes and race horses.

**4. Pistil/Gynoecium** It is the female unit of flower. A flower may be monocarpellary (having one pistil) or multicarpellary (having more than one pistils). Pistils may be syncarpous (fused together) or apocarpous (free).

**The main parts of pistils are:**

(i) Stigma receives pollen grains.

(ii) Style is the elongated slender part beneath the stigma.

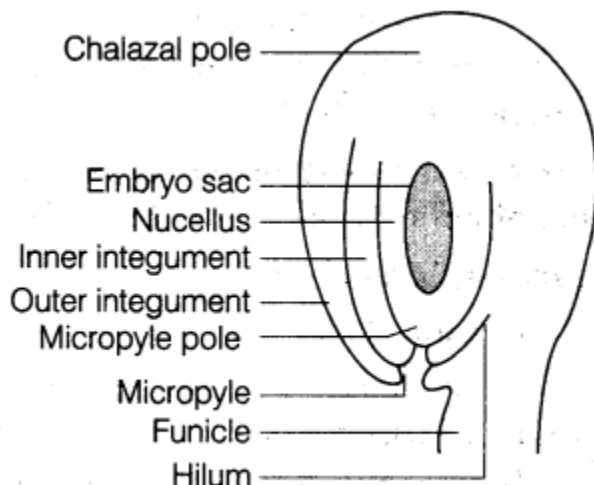
(iii) Ovary the bulged part at the base of style.

Placenta is located inside the ovarian cavity or locule. Megasporangia, commonly called ovules arise from the placenta. Ovule is attached to the placenta by a stalk called funicle. The number of ovules in an ovary may be one (wheat, paddy and mango) to many (papaya, water melon and orchids).



The main parts of megasporangium (ovule) are:

- (i) Hilum is a junction between ovule and funicle.
- (ii) Each ovule has one or two protective envelopes called integuments.
- (iii) Micropyle is an opening present at the tip where integument is absent.
- iv) Chalaza is opposite to the micropylar end representing the basal part of the ovule.
- (v) The integuments encloses a mass of cells called the nucellus which have food reserves.
- (vi) Embryo sac or female gametophyte is located in the nucellus (generally one formed from megaspores through reductional division)



**Diagrammatic view of a typical anatropous ovule**

**5. Megasporogenesis** is the process of formation of megaspores from the Megaspore Mother Cell (MMC). The MMC is a large cell with dense cytoplasm and prominent nucleus. It undergoes meiosis resulting in the production of four megaspores.

**6. Development of Female Gametophyte Different stages of development of female gametophyte are given below:**

- (i) One of the megaspores is functional, while the other three degenerate in majority of angiosperms.
- (ii) Only the functional megaspore develops into the female gametophyte or embryo sac. This is called monosporic development.
- (iii) Nucleus of the functional megaspore divides mitotically to form two nuclei, which move to the opposite poles forming the 2-nucleate embryo sac.
- (iv) Nuclear divisions result into the formation of 4-nucleate and later 8-nucleate stages

of the embryo sac.

(v) Six of the eight nuclei are surrounded by cell walls and organised into cells.

The remaining two nuclei called polar nuclei, are situated below the egg apparatus in the large central cell.

(vi) Three cells group together at the micropylar end and constitute the egg apparatus.

(vii) The egg apparatus consists of two synergids and one egg cell.

(viii) A filiform apparatus made of cellular thickenings of synergids at the micropylar end, plays an important role in guiding the pollen tubes into the synergid.

(ix) At the chalazal end, three cells are present called antipodals.

(x) Thus, a typical angiosperm embryo sac, at maturity is 8-nucleate and 7-celled.

### **Multiple choice questions**

Question 1.

What is the function of filiform apparatus in an angiospermic embryo sac?

- (a) Brings about opening of the pollen tube
- (b) Guides the pollen tube into a synergid
- (c) Prevents entry of more than one pollen tube into a synergid
- (d) None of these

Answer:

- (b) Guides the pollen tube into a synergid

Question 2.

The female gametophyte of a typical dicot at the time of fertilisation is

- (a) 8 – celled
- (b) 7 – celled
- (c) 6 – celled
- (d) 5 – celled

Answer:

- (b) 7 – celled

Question 3.

Polygonum type of embryo sac is

- (a) 8 – nucleate, 7 – celled
- (b) 8 – nucleate, 8 – celled
- (c) 7 – nucleate, 7 – celled
- (d) 4 – nucleate, 3 – celled

Answer:

- (a) 8 – nucleate, 7 – celled

Question 4.

Both chasmogamous and cleistogamous flowers are present in

- (a) Helianthus
- (b) Commelina
- (c) Rosa

(d) Gossypium

Answer:

(b) Commelina

Question 5.

Even in absence of pollinating agents seed-setting is assured in

(a) Commelina

(b) Zostera

(c) Salvia

(d) Fig

Answer:

(a) Commelina

Question 6.

Male and female flowers are present on different plants (dioecious) to ensure xenogamy, in

(a) papaya

(b) bottle gourd

(c) maize

(d) all of these.

Answer:

(a) papaya

Question 7.

Feathery stigma occurs in

(a) pea

(b) wheat

(c) Datura

(d) Caesalpinia

Answer:

(b) wheat

Question 8.

Plants with ovaries having only one or a few ovules are generally pollinated by

(a) bees

(b) butterflies

(c) birds

(d) wind

Answer:

(d) wind

Question 9.

Which of the following is not a water pollinated plant ?

(a) Zostera

(b) Vallisneria

(c) Hydrilla

(d) Cannabis

Answer:

(d) Cannabis

Question 10.

Spiny or sticky pollen grains and large, attractively coloured flowers are associated with

- (a) hydrophily
- (b) entomophily
- (c) ornithophily
- (d) anemophily

Answer:

(b) entomophily

Question 11.

Endospermic seeds are found in

- (a) castor
- (b) barley
- (c) coconut
- (d) all of these

Answer:

(d) all of these

Question 12.

In albuminous seeds, food is stored in \_\_\_\_\_ and in non albuminous seeds, it is stored in \_\_\_\_\_.

- (a) endosperm, cotyledons
- (b) cotyledons, endosperm
- (c) nucellus, cotyledons
- (d) endosperm, radicle

Answer:

(a) endosperm, cotyledons

Question 13.

Persistent nucellus is called as \_\_\_\_\_ and is found in \_\_\_\_\_.

- (a) perisperm, black pepper
- (b) perisperm, groundnut
- (c) endosperm, black pepper
- (d) endosperm groundnut

Answer:

(a) perisperm, black pepper

Question 14.

Identify the wrong statement regarding post-fertilisation development.

- (a) The ovary wall develops into pericarp.
- (b) The outer integument of ovule develops into tegmen.
- (c) The fusion nucleus (triple nucleus) develops into endosperm.
- (d) The ovule develops into seed.

Answer:

(b) The outer integument of ovule develops into tegmen.

Question 15.

Polyembryony commonly occurs in

- (a) banana
- (b) tomato
- (c) potato
- (d) citrus.

Answer:

(d) citrus.

Answer the following questions

**1. Name the parts of an angiosperm flower in which development of male and female gametophytes take place.**

**Ans:** Development of male gametophyte (micro- gametogenesis) occurs in pollen sac of anther up to 2 – celled stage. The female gametophyte develops (megagametogenesis) in the nucellus of ovule.

**2 Differentiate between microsporogenesis and megasporogenesis. Which type of cell division occurs during these events? Name the structures formed at the end of these two events?**

**Ans:** Differences between microsporogenesis and megasporogenesis are as follows –

	<b>Microsporogenesis</b>		<b>Megasporogenesis</b>
1.	The process of formation and differentiation of pollen grains from microspore mother cells by meiosis is known as microsporogenesis.	1.	The process of formation and differentiation of megaspores from megaspore mother cells by meiosis is known as megasporogenesis.
2.	Pollen grains are produced in the anther which is a broader knob like fertile part of the stamen.	2.	Ovules (which are the future seeds) are formed in the ovary.
3.	All the four pollen grains that are formed from microspore mother cell are functional.	3.	Only one out of the four megaspores is functional.

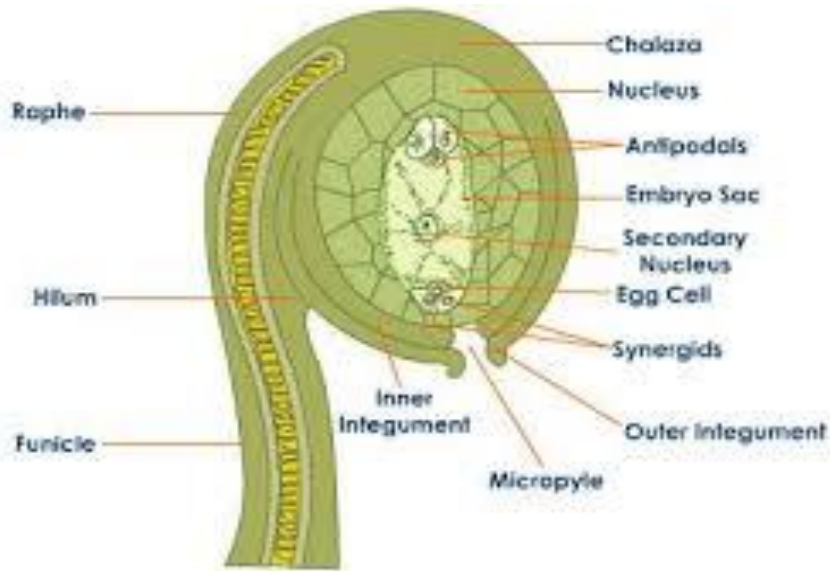
Each microspore mother cell and megaspore mother cell contain two sets of chromosomes and are therefore diploid. The diploid megaspore mother cell and microspore mother cell enlarges and undergo meiosis to produce, four haploid cells called megaspores and microspores respectively. The chromosome number is reduced by half and therefore megaspores and microspores are haploid.

Microsporogenesis and megasporogenesis give rise to pollen grains and embryo sac respectively. Pollen grain is the male gametophyte and embryo sac represents the female gametophyte.

**3 Arrange the following terms in the correct development sequence: Pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell, male gametes.**

**Ans:** The correct developmental sequence for the formation of male gametes is :

Sporogenous tissue —» Pollen mother cell —» Microspore tetrad —» Pollen grain —» Male gametes.



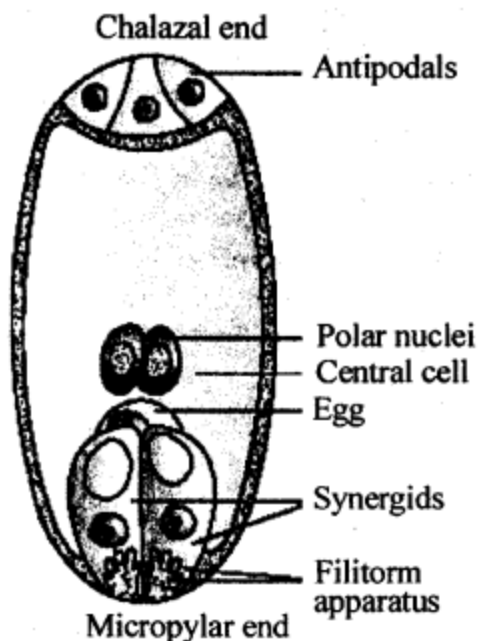
A typical angiospermic ovule is a small structure which is formed in the ovary. Ovule first develops as a projection on the placenta and composed of multilayered cellular tissue called the nucleus. The hypodermal cell of die nucleus enlarges and transformed into megaspore mother cell. This cell undergoes meiosis to produce four haploid cells only one of which develops & forms embryo sac (female gametophyte). An ovule may be surrounded by one or two protective layers called integuments, leaving a small opening at one end termed as micropyle which acts as passage for the entry of the pollen tube into the ovule. Thus, a typical ovule consists of a fully developed embryo sac with the nucleus and integuments.

**5. What is meant by monosporic development of female gametophyte?**

**Ans:** In majority of flowering plants one of the megaspores is functional while the other three degenerate. Only the functional megaspore develops into the female gametophyte or embryo sac. This method of development of embryo sac from a single megaspore is called monosporic development.

6. With a neat diagram explain the 7-celled, 8- nucleate nature of the female gametophyte.

Ans:



**Fig. A diagrammatic representation of the mature embryo sac.**

Embryo sac (or female gametophyte) is formed by three successive mitotic divisions that take place in the nucleus of megaspore.

The nucleus of the functional megaspore divides meiotically to form two nuclei which move to the opposite poles, forming the 2-nucleate embryo sac. Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of the embryo sac. After the 8-nucleate stage, cell walls are laid down leading to the organisation of the typical female gametophyte or embryo sac. Six of the eight nuclei are grouped together at micropylar and chalazal end and form the egg apparatus and antipodals respectively. The large central cell left over with two polar nuclei. Thus, a typical female gametophyte consists of 7 cells with 8 nucleus.

**7. What are chasmogamous flowers? Can cross-pollination occur in deistogamous flowers? Give reasons for your answer**

Ans: Chasmogamous flowers are those flowers which are open with exposed anther and stigma.

Cleistogamous flowers are those flowers which do not open at all. In these flowers, the anthers and stigma lie close to each other, when anthers dehisce in the flower buds, the pollen grains come in the contact with stigma to effect pollination. So

these flowers are invariably self-pollinated as the flowers remain closed and there is no chance of cross pollen landing on the stigma. Pollination and seed setting are assured even in the absence of pollinators

### **8. Mention two strategies evolved to prevent self-pollination in flowers.**

**Ans:** Continued self-pollination decreases the vigour and vitality of a particular race. Thus, flowering plants have developed many devices to discourage self-pollination and to encourage cross-pollination.

Dichogamy and self-sterility are two most common devices that ensure cross-pollination.

Dichogamy – Maturation of anther and stigma at different times in a bisexual flower prevent self-pollination.

Self-sterility (or self-incompatibility) – Due to the presence of self-sterile gene in some flowers, pollen grains do not germinate on the stigma of that flowers. e.g., - tobacco, potato.

### **9. What is self-incompatibility? Why does self-pollination not lead to seed formation in self-incompatible species?**

**Ans:** If a pistil carrying functional female gametes fails to set seeds following pollination with viable and fertile pollen, capable of bringing about fertilisation in another pistil, the two are said to be incompatible, and the phenomenon is known as sexual incompatibility. Sexual incompatibility may be interspecific (between individuals of different species) or intraspecific (between individuals of the same species). The latter is also called self-incompatibility. Self-incompatibility is a gene-physiological process. Incompatibility reactions are controlled by a single gene, called S-gene, which has several alleles. Pollen grains that possess the S-allele common to any one of the two alleles present in the cells of the pistil, will not be functional on that particular pistil. However, every pollen grain having no common S alleles with pistil would be functional on the pistil of a that plant. As self pollens are unable to fertilise the egg to form pmbryo, hence seeds are not formed in self-incompatible species.

### **10. What is bagging technique? How is it useful in a plant breeding programme?**

**Ans:** It is the covering of emasculated flowers (removal of anthers in bud condition from a bisexual flower by a bag of butter paper or polythene in their bud condition i.e., before anthesis) to prevent contamination of its stigmas with unwanted pollens. When the stigmas of emasculated flowers mature the bags are removed, stigmas are dusted with pollen grains of desired male . plants by means of a presterilized brush and flowers are rebagged till fruit develop. This technique is mainly used in artificial hybridization. Plant breeders often use this technique to prevent the contamination of stigma of the flowers from unwanted pollen grains.

### **11. What is triple fusion? Where and how does it take place? Name the nuclei involved in triple fusion.**



**Ans:** Fusion of second male gamete with the two polar nuclei located in the central cell to form the triploid primary endosperm nucleus (PEN) is called triple fusion or vegetative fertilization. This process takes place in the embryo sac. After reaching the ovary, pollen tube enters into the embryo sac from the micropylar end. After penetration, the tip of the pollen tube ruptures releasing the two male gametes. The one male gamete fuses with the egg to form the diploid zygote. This process is called syngamy and the other male gamete fuses with the two polar nuclei to form the triploid primary endosperm & this process is known as triple fusion. These two events of fertilization constitute the process

**12. Why do you think the zygote is dormant for sometime in a fertilized ovule?**

**Ans:** The zygote after a period of rest develops into embryo. Most zygotes remain dormant till certain amount of endosperm forms. They do so, to provide assured nutrition to the developing embryo of double fertilization.

**13. Differentiate between:**

- (a) hypocotyl and epicotyl;
- (b) coleoptile and coleorrhiza;
- (c) integument and testa;
- (d) perisperm and pericarp

<b>Differences between Epicotyl and Hypocotyl</b>			
<i>Epicotyl</i>		<i>Hypocotyl</i>	
1.	It is the part of embryonal axis in between plumule and cotyledon node.	1.	It is the part of embryonal axis in between cotyledonary node and radicle.
2.	In hypogeal germination, epicotyl elongates so that cotyledons remain in the soil.	2.	In epigeal germination, hypocotyl elongates so that cotyledons come out of soil.
3.	The terminal end of epicotyl is plumule.	3.	The terminal end of hypocotyls is radicle.

<b>Differences between Coleoptile and Coleorrhiza</b>			
<i>Coleoptile</i>		<i>Coleorrhiza</i>	
1.	The epicotyl bearing shoot apex and leaf primordia is enclosed in a foliar structure called coleoptile.	1.	The radical and root cap are enclosed in a sheath called coleorrhiza .
2.	Coleoptile has a terminal pore for the emergence of first leaf.	2.	Coleorrhiza is a solid structure.
3.	It protects the plumule during emergence from soil.	3.	It does not protect the radicle during its passage into the soil.
4.	It grows much beyond the grain.	4.	After emergence from grain it stops growing.
5.	Coleoptile after emergence from soil during germination, becomes green and does photosynthesis.	5.	Coleorrhiza does not come out of soil. It remains nongreen.

<b>Differences between Integument and Testa</b>			
<i>Integument</i>		<i>Testa</i>	
1.	It is the covering of the ovule.	1.	It is outer covering of seed.
2.	It is thin, one or two layered.	2.	It is quite thick and one layered.
3.	Its cells are living.	3.	Its cells are dead.
4.	Sclereids are absent.	4.	Cells are rich in sclereids.
5.	It arises from chalazal end of ovule.	5.	It is derived from outer integument of ovule after fertilization.
6.	It is prefertilized structure.	6.	It is a post fertilized structure.

<b>Differences between Perisperm and Pericarp</b>			
<i>Perisperm</i>		<i>Pericarp</i>	
1.	It is unused nucellus in the seed.	1.	It is the covering of fruit that develops from ovary wall.
2.	It is a part of seed.	2.	It is a part of fruit.
3.	It is usually dry.	3.	It is dry or fleshy.
4.	It is often nonfunctional for seed.	4.	It is protective covering and also helps in dispersal and nutrition.
5.	Perisperm is present in only a few seeds.	5.	It is found in all fruits.

**14. Why is apple called a false fruit? Which Part(s) of the flower forms the fruit?**

**Ans:** Botanically ripened ovary is called a true fruit. The fruits in which thalamus and other floral parts develop along with the ovary are called false fruits. For example – apple, strawberry, cashew etc. In apple the main edible portion of the fruit is the fleshy thalamus. Ovary forms the fruit after fertilization or without fertilization in parthenocarpic fruits.

**15. What is meant by emasculation? When and why does a plant breeder employ this technique?**

**Ans:** Removal of stamens or anthers of a bisexual flower without affecting the female reproductive organs is called emasculation. This technique is used in artificial hybridisation. In such crossing experiments it is important to make sure that only the desired pollen grains are used for pollination and the stigma is protected from contamination from unwanted pollens. This is achieved by emasculation and bagging technique. This technique is used to obtain desired variety of seeds.

**16. If one can induce parthenocarpy through the application of growth substances, which fruits would you select to induce parthenocarpy and why?**

**Ans:** Parthenocarpic fruits are seedless. They develop from ovary without fertilization. Banana, grapes, oranges, Pineapple, Guava, Watermelon, lemon are selected because these seedless of

units are of high economic importance. The fruits in which seeds or seed part form edible portion (e.g., Pomegranate) are not selected to induce parthenocarpy.

### 17. Explain the role of tapetum in the formation of pollen grain wall.

**Ans:** Tapetum is the innermost wall layer of anther. The cells of this layer have large nuclei and dense cytoplasm. This layer is of great physiological importance as most of the food material from outside passes through this layer. At maturity, these cells degenerate and provide nourishment to developing microspores or pollens inside. Tapetum is the layer, which secretes both enzymes and substances of hormonal nature.

The main function of tapetum is to provide nutrition to pollens but it also secretes some substances of utmost importance like :

- **Callase enzyme :** Tapetum secretes callase enzyme which dissolves callose substances by which four pollens of a pollen tetrad are united, hence separating microspores or pollens of a tetrad.
- **Ubisch bodies :** These bodies of lipid nature are also secreted by tapetum. Ubisch bodies get covered with sporopollenin and thus increase thickness of exine (i.e., outer layer of pollen wall). Ubisch bodies are spheroidal and have diameter of only few microns. These are produced only by glandular tapetum (not by amoeboid tapetum).
- **Pollen kit substances :** Tapetum also secretes pollen kit, outer most oily, thick, viscous, sticky, electron dense homogeneous coating of pollen grains of many entomophilous plants.

### 18. What is apomixis and what is its importance?

**Ans:** Apomixis is a mode of asexual reproduction that produces seeds without fertilization, e.g. - some species of Asteraceae and Grasses. This method is important in hybrid seed industry. Hybrids are extensively cultivated for increasing productivity. But the main drawback is that the hybrid seeds are to be produce every year because the seeds of the hybrid plants do not maintain hybrid characters for longer period due to segregation of characters. This can be avoided if apomixis can be introduced in hybrid seeds. For this reason scientists are trying hard to identify genes for apomixis.

## Chap.3 HUMAN REPRODUCTION

**1. Humans** are sexually reproducing and viviparous organisms. There are remarkable differences between the reproductive events and systems in male and female.

**2. Male reproductive system** includes a pair of testes, accessory ducts, glands and the external genitalia.

(i) Testes are located outside the abdominal cavity within a pouch called scrotum.

Scrotum maintains the low temperature of the testes (2-2.5°C lower than the normal body temperature) required for spermatogenesis.

(a) Each testis is oval-shape (length 4-5 cm and width 2-3 cm) and covered by a dense covering called tunica albuginea.

(b) Internally it is divided into about 250 compartments known as testicular lobules.

(c) Each lobule contains 1-3 highly coiled (structural and functional units of testis) called seminiferous tubules in which sperms are produced.

d) Seminiferous tubule is lined on its inside by two types of cells called male germ cells (spermatogonia) and Sertoli cells.

(e) Male germ cells undergo meiotic divisions finally leading to sperm formation.

(f) Sertoli cells provide nutrition to the germ cells.

g) Interstitial spaces are present in outside regions of seminiferous tubules which contain small blood vessels and interstitial cells or Leydig cells.

(h) Leydig cells synthesise and secrete the testicular hormones called androgens.

**(ii) Male accessory** ducts include rete testis, vasa efferentia, epididymis and vas deferens.

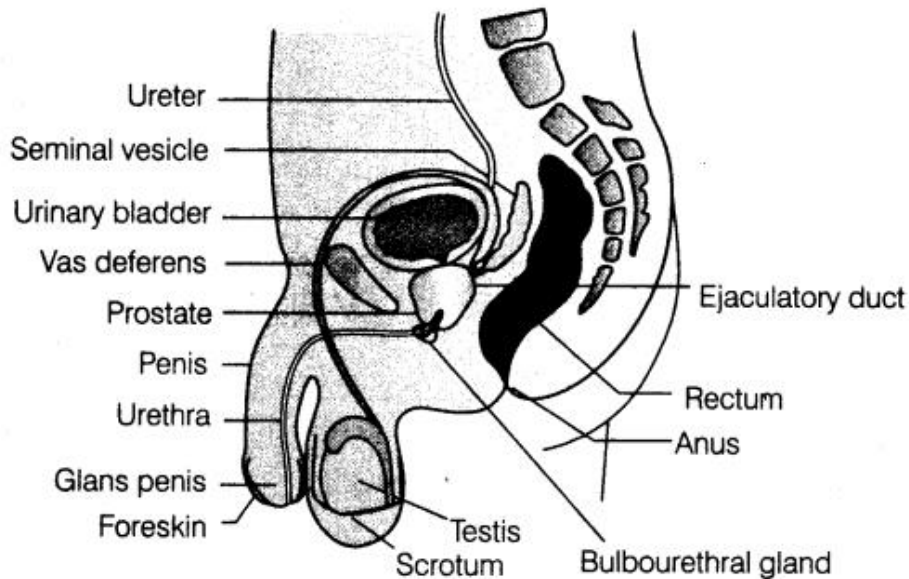
(a) The intratesticular duct system starts with tubuli recti, which are short, straight end segments of the seminiferous tubules. These tubules connect the seminiferous tubules to the highly anastomosing, cuboidal epithelium-lined channels called rete testis.

b) From rete testis, 10-25 fine tubules arise called vasa efferentia that leave the testis and open into the epididymis.

c) Epididymis leads to vas deferens that ascends to the abdomen and loops over the urinary bladder.

Diagrammatic sectional view of male pelvis showing reproductive system

Diagrammatic view of male reproductive system [part of testis is open to show inner details]



**Diagrammatic sectional view of male pelvis showing reproductive system**

Urinary bladder receives a duct from the seminal vesicle to form ejaculatory duct that runs through the prostate and opens into urethra.

(e) Urethra receives the ducts of prostate gland and the bulbourethral gland (Cowper's glands) a little ahead and runs through the penis to its external opening called urethral meatus.

(iii) The accessory glands of male reproductive system include

(a) A pair of seminal vesicles, a prostate gland and a pair of bulbourethral glands (Cowper's glands).

(b) The secretion of all these glands is called seminal plasma.

(c) Seminal plasma contains fructose, calcium and some enzymes. It is to provide nutrition to the spermatozoa, while travelling through female reproductive tract.

(d) Seminal plasma along with sperms is called semen.

(e) Secretion of bulbourethral glands also helps in the lubrication of the penis.

iv) External genitalia is the penis. It is made up of special erectile tissue that helps in erection of the penis. The enlarged tip of the penis is called glans penis. It is covered by a loose fold of skin called foreskin or prepuce.

**3. Female reproductive system** consists of a pair of ovaries, secondary sex organs, external genitalia and mammary glands.

(i) Ovaries are primary female sex organs which produce female gametes called ova and secrete the female sex hormones.

(a) These are located one on each side of the lower abdomen.

(b) It is almond-shaped, 2-4 cm in length, 1.5 cm in width.

(c) It is connected to the pelvic wall and uterus by ligaments.

(e) Stroma is divided into two regions, i.e. peripheral cortex and inner medulla.

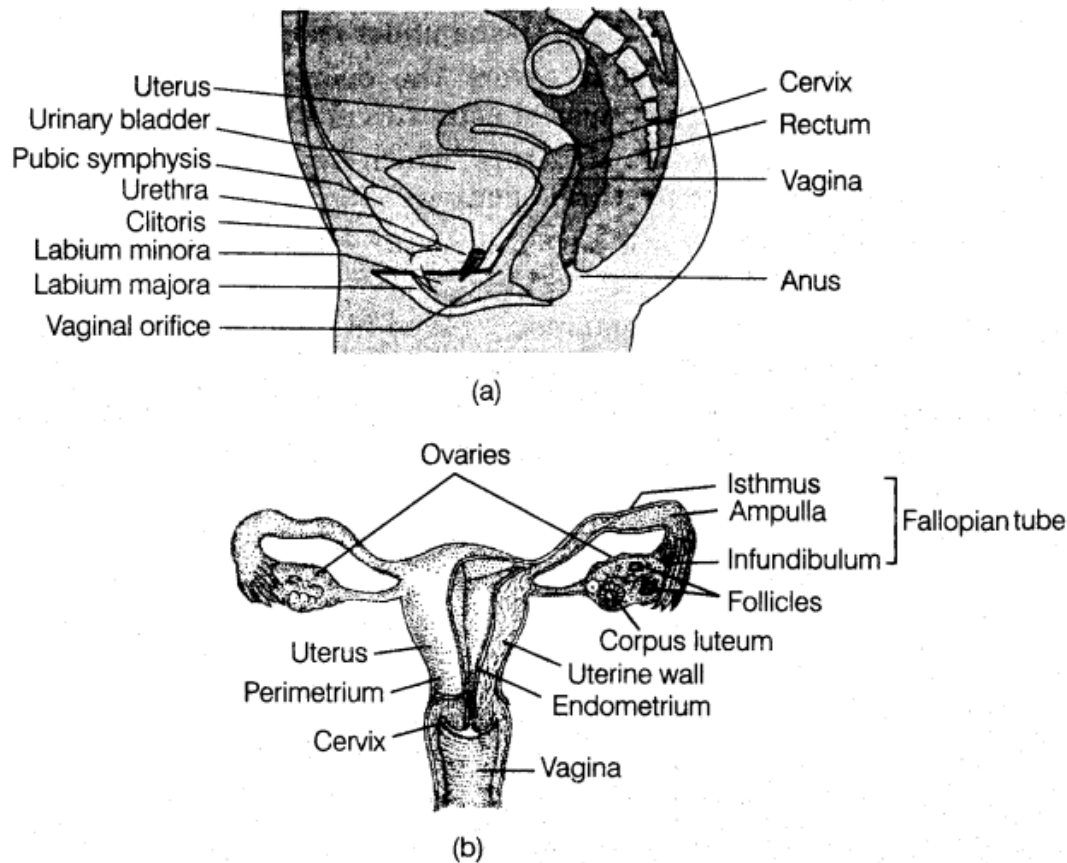
(ii) The female accessory ducts constitute oviducts (Fallopian tubes), uterus and vagina.

(iii) Each Fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus. d) Each ovary is covered by a thin epithelium which encloses the ovarian stroma.

e) Stroma is divided into two regions, i.e. peripheral cortex and inner medulla.

(ii) The female accessory ducts constitute oviducts (Fallopian tubes), uterus and vagina.

(iii) Each Fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus.



**Female reproductive system (a) Lateral view (b) Sectional view**

a) The part of oviduct closer to the ovary is funnel-shaped infundibulum.

(b) The edges of infundibulum possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation.

(c) Infundibulum leads to a wider part of the oviduct called ampulla.

(d) Isthmus is the last part of the oviduct, which has a narrow lumen and it joins the uterus.

(iv) Uterus or womb is a pear-shaped muscular organ. It is attached to the pelvic wall and supported by ligaments.

a) Wall of the uterus has three layers of tissue.

(b) Perimetrium is the outermost thin membranous layer, myometrium is the middle thick layer of smooth muscles and endometrium is the innermost glandular layer which lines the uterine cavity.

(c) Uterus opens into the vagina through a narrow cervix, its cavity is called cervical canal, which along with vagina forms birth canal.

d) Endometrium layer undergoes cyclic changes during menstrual cycle.

(e) Smooth muscles in myometrium contract during parturition to deliver the baby.

**(v) Vagina is a muscular tube-like structure that opens to the outside. It receives spermatozoa during insemination and serve as birth canal.**

**vi) Female external genitalia** include mons pubis, labia majora, labia minora, clitoris and hymen.

(a) Mons pubis is a cushion of fatty tissue covered by skin and pubic hair.

(b) Labia majora are fleshy folds of tissue which extend down from the mons pubis and surround the vaginal opening.

(c) Labia minora are paired folds of tissue under the labia majora.

(d) Hymen is a membrane that covers the opening of vagina partially. It gets ruptured during vigorous physical activities or during the first coitus.

(e) Clitoris is a tiny finger-like structure, which lies at the upper junction of the two labia minora above the urethral opening.

**vii) Mammary glands** (breasts) are paired structures that contain glandular tissue and variable amount of fat.

(a) Glandular tissue of each mammary gland is divided into 15-20 mammary lobes containing the cluster of cells called alveoli.

(b) The cells of alveoli secrete milk, which is stored in the cavities (lumen) of alveoli.

(c) Alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct.

(d) Several mammary ducts join to form a wider mammary ampulla, which is connected to lactiferous duct through which milk is sucked out.

### **Multiple choice questions**

Question 1.

Ovulation in the human female normally takes place during the menstrual cycle

(a) at the mid secretory phase

(b) just before the end of the secretory phase

(c) at the beginning of the proliferative phase

(d) at the end of the proliferative phase.

Answer:

(d) at the end of the proliferative phase.

Question 2.

After ovulation Graafian follicle regresses into

(a) corpus atresia

(b) corpus callosum

(c) corpus luteum

(d) corpus albicans

Answer:

(c) corpus luteum

Question 3.

Immediately after ovulation, the mammalian egg is covered by a membrane known as

- (a) chorion
- (b) zona pellucida
- (c) corona radiata
- (d) vitelline membrane.

Answer:

(c) corona radiate

Question 4.

Which one of the following events is correctly matched with the time period in a normal menstrual cycle ?

- (a) Release of egg : 5 th day
- (b) Endometrium regenerates : 5 – 10 days
- (c) Endometrium secretes nutrients for implantation: 11 – 18 days
- (d) Rise in progesterone level : 1 – 15 days

Answer:

(b) Endometrium regenerates : 5 – 10 days

Question 5.

If mammalian ovum fails to get fertilised, which one of the following is unlikely ?

- (a) Corpus luteum will disintegrate.
- (b) Progesterone secretion rapidly declines.
- (c) Estrogen secretion increases.
- (d) Primary follicle starts developing.

Answer:

(c) Estrogen secretion increases.

Question 6.

A human female reaches menopause around the age of

- (a) 50 years
- (b) 15 years
- (c) 70 years
- (d) 25 years.

Answer:

(a) 50 years

Question 7.

A reaction of granules content which harden the zona pellucida and ensures sure block to



polyspermy is

- (a) acrosomal reaction
- (b) cortical reaction
- (c) acrosin reaction
- (d) bindin reaction.

Answer:

- (b) cortical reaction

Question 8.

Which part of the sperm plays an important role in penetrating the egg membrane ?

- (a) Allosome
- (b) Tail
- (c) Autosome
- (d) Acrosome

Answer:

- (d) Acrosome

Question 9.

In oocyte secondary maturation occurs in

- (a) ovary
- (b) abdominal cavity
- (c) Fallopian tube
- (d) uterus.

Answer:

- (c) Fallopian tube

Question 10.

Besides activating the egg another role of a sperm is to carry to egg

- (a) RNA
- (b) mitochondria
- (c) DNA
- (d) ribosomes.

Answer:

- (c) DNA

Question 11.

Preparation of sperm before penetration of ovum is

- (a) spermiation
- (b) cortical reaction
- (c) spermiogenesis
- (d) capacitation.

Answer:

- (a) spermiation

Question 12

Spermiation is the process of the release of sperms from

- (a) seminiferous
- (b) vas deferens
- (c) epididymis
- (d) prostate gland

Answer:

- (a) seminiferous

Question 13.

Mature Graafian follicle is generally present in the ovary of a healthy human female around

- (a) 5-8 day of menstrual cycle
- (b) 11-17 day of menstrual cycle
- (c) 18-23 day of menstrual cycle
- (d) 24-28 day of menstrual cycle.

Answer:

- (b) 11-17 day of menstrual cycle

Question 14.

Acrosomal reaction of the sperm occurs due to

- (a) its contact with zona pellucida of the ova
- (b) reactions within the uterine environment of the female
- (c) reactions within the epididymal environment of the male
- (d) androgens produced in the uterus.

Answer:

- (a) its contact with zona pellucida of the ova

Question 15.

Which one of the following is not a male accessory gland ?

- (a) Seminal vesicle
- (b) Ampulla
- (c) Prostate
- (d) Bulbourethral gland

Answer:

- (b) Ampulla

1. Fill in the blanks:

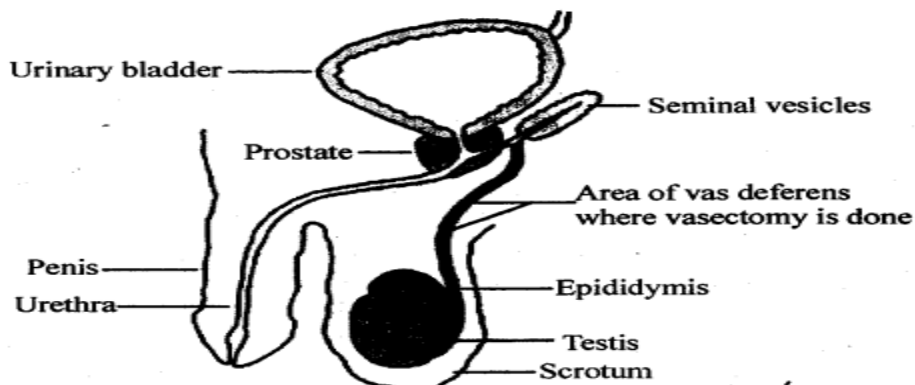
- (a) Humans reproduce \_\_\_\_\_ (asexually/sexually).
- (b) Humans are \_\_\_\_\_ (oviparous, viviparous, ovoviviparous).

- (c) Fertilization is \_\_\_\_\_ in humans (external/internal).  
 (d) Male and female gametes are \_\_\_\_\_ (diploid/haploid).  
 (e) Zygote is \_\_\_\_\_ (diploid/haploid).  
 (f) The process of release of ovum from a mature follicle is called \_\_\_\_\_ .  
 (g) Ovulation is induced by a hormone called \_\_\_\_\_  
 (h) The fusion of male and female gametes is called \_\_\_\_\_ .  
 (i) Fertilization takes place in \_\_\_\_\_  
 (j) Zygote divides to form \_\_\_\_\_ which is implanted in uterus.  
 (k) The structure which provides vascular connection between foetus and uterus is called \_\_\_\_\_

- Ans:** (a) sexually  
 (b) viviparous  
 (c) internal  
 (d) haploid  
 (e) diploid  
 (f) ovulation  
 (g) LH (Luteinizing hormone)  
 (h) fertilization  
 (i) ampullary-isthmic junction (fallopian tube)  
 (j) blastocyst  
 (k) placenta (Umbilical cord)

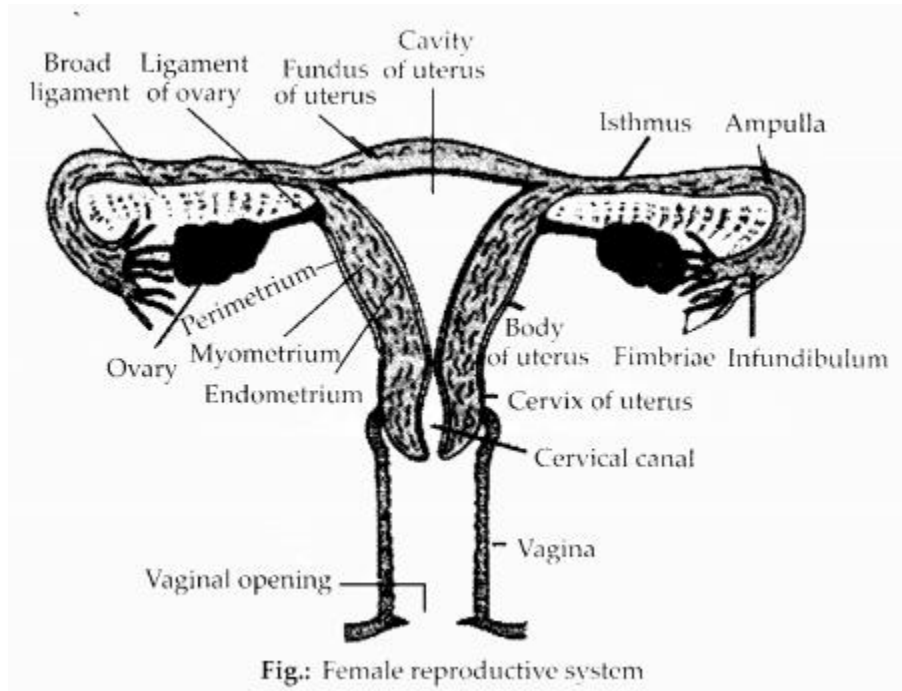
**Answer the following questions**

**2 Draw a labelled diagram of male reproductive system.**



**Fig. : Male reproductive system**

### 3 Draw a labelled diagram of female reproductive system.



### 4. Write two major functions each of testis and ovary.

**Ans:** Testes are components of both the reproductive system (being gonads) and the endocrine system (being endocrine glands). The respective functions of the testes are – producing sperm (spermatozoa) by the process of spermatogenesis and producing male sex hormones, of which testosterone is the best-known. Testosterone stimulates development of testes and of male secondary sexual characteristics.

The ovaries have two major functions. One is the production of eggs or ova, and the second is the production of hormones or chemicals which regulate menstruation and other aspects of health and well-being, including sexual well-being. Estrogen and progesterone are the most important hormones which serve many functions like, they induce and maintain the physical changes during puberty and the secondary sex characteristics and they support maturation of the uterine endometrium in preparation for implantation for a fertilised egg, etc

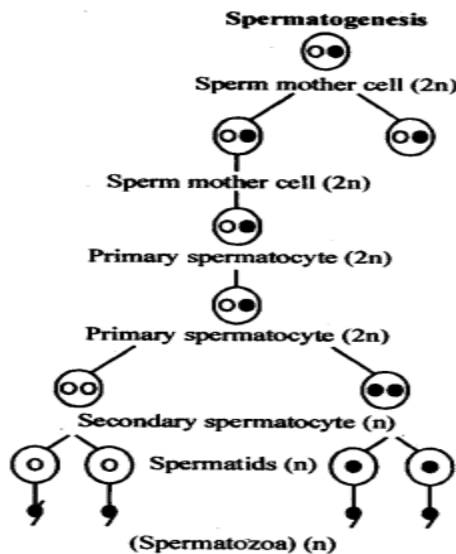
### 5. Describe the structure of a seminiferous tubule.

**Ans:** The seminiferous tubule is a structural unit in the adult testis. The seminiferous tubules are situated in testicular lobules. Seminiferous tubule consists of two types of cells – Sertoli or supporting cells & spermatogenic cells| Sertoli cells, are elongated and pyramidal & partially envelop the spermatogenic cells. The cells provide nourishment to the developing spermatogenic

cells. Spermatogenic cells are stacked in 4-8 layers. These cells divide several times & differentiate to produce spermatozoa. Between seminiferous tubules lie the interstitial cells or Leydig cells which produce testosterone hormone.

### 6 . What is spermatogenesis? Briefly describe the process of spermatogenesis.

**Ans:** Spermatogenesis is the process of producing sperms with half the number of chromosomes (haploid) as somatic cells. It occurs in seminiferous tubules. Sperm production begins at puberty and continues throughout life with several hundred million sperms being produced each day. Once sperm are formed they move into the epididymis, where they mature and are stored. During spermatogenesis one spermatogonium produces 4 sperms. Spermatogenesis completes through the following phases – multiplicative phase, growth phase, maturation phase & spermiogenesis. In the multiplicative phase the sperm mother cells divide by mitosis & produce spermatogonia. The spermatogonia grow in size to form large primary spermatocytes by getting nourishment from Sertoli cells in the growth phase. Maturation phase involves meiosis I in which primary spermatocytes divide to produce secondary spermatocytes and meiosis II which produces spermatids. Thus each primary spermatocyte gives rise to four haploid spermatids. Spermiogenesis or spermateliosis is the process of formation of flagellated spermatozoa from spermatids. Spermiogenesis begins in the seminiferous tubules but is usually completed in the epididymis.



### 7. Name the hormones involved in regulation of spermatogenesis.

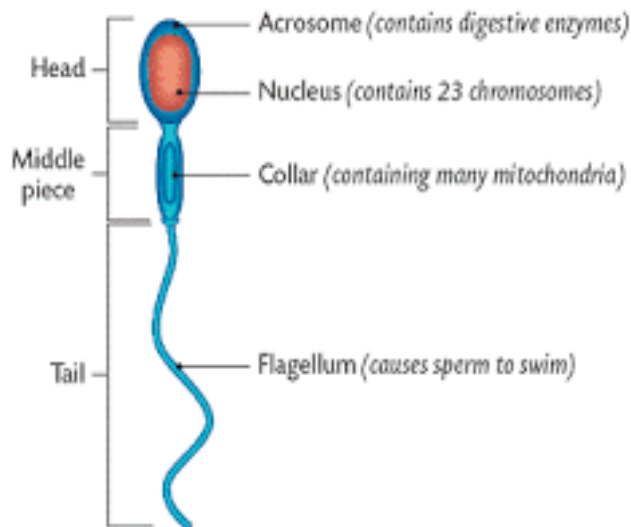
**Ans:** The hormones involved in regulation of spermatogenesis are GnRH, LH, FSH and androgens.

Spermatogenesis starts at the age of puberty due to significant increase in the secretion of gonadotropin releasing hormone (GnRH). The increased levels of GnRH then acts at the anterior pituitary gland and stimulates secretion of two gonadotropins – luteinising hormone (LH) and follicle stimulating hormone (FSH). LH acts at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens, in turn, stimulate the process of spermatogenesis. FSH acts on the Sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis.

### 8 Define spermiogenesis and spermiation.

**Ans:** Spermiogenesis is the process of transformation of spermatids into mature flagellated spermatozoa (sperms). Spermiation is the process of release of mature spermatozoa. In this spermatozoa are shed into the lumen of seminiferous tubule for transport

### 9 Draw a labelled diagram of sperm



### 10 .What are the major components of seminal plasma?

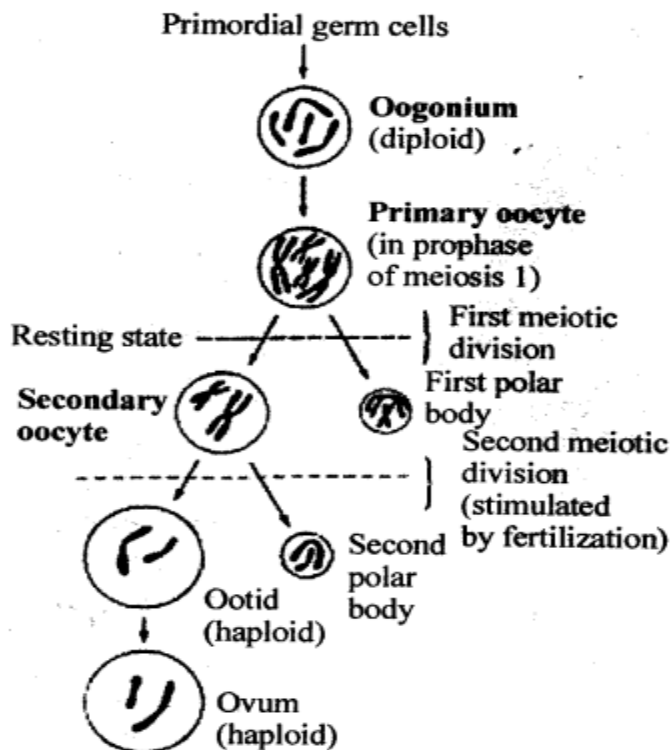
**Ans:** Seminal plasma is the fluid in which sperm is ejaculated. Major components of seminal plasma are secretions from seminal vesicles, prostate and bulbourethral gland and sperms from testis. It is rich in fructose and contains enzymes, citric acid, hormones like prostaglandins, calcium and clotting proteins.

## 11. What are the major functions of male accessory ducts and glands?

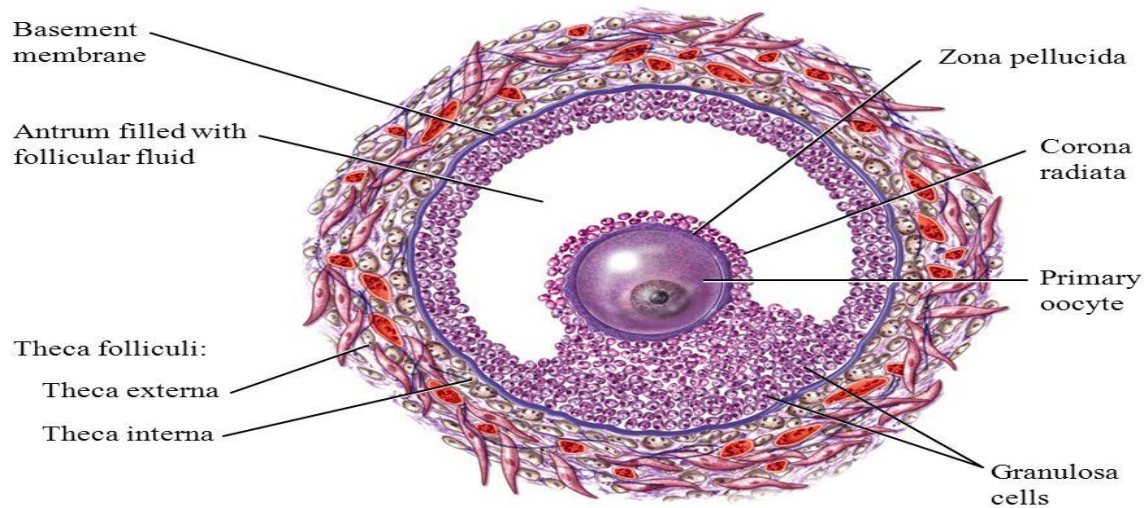
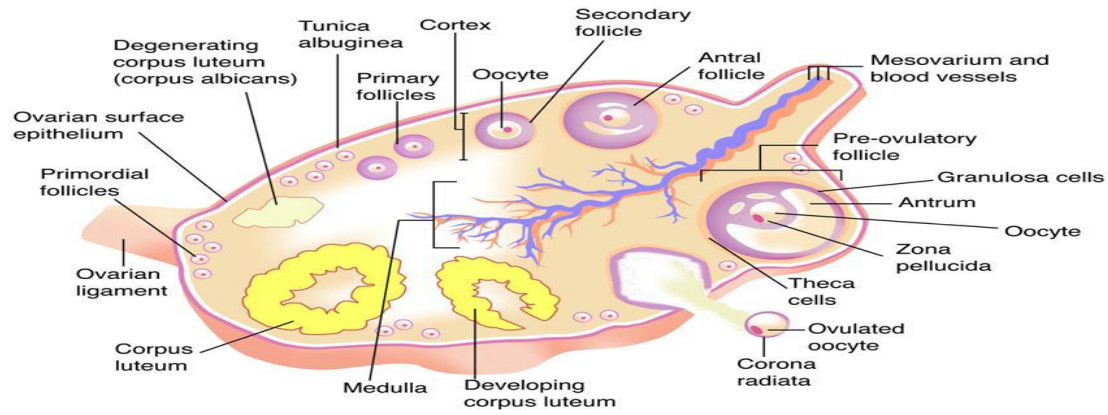
**Ans:** Male accessory ducts include rete testis, vasa efferentia, epididymis and vas deferens. These ducts store and transport sperms from the testis to the outside through urethra. The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes. The secretions of bulbourethral glands also helps in the lubrication of the penis.

## 2. What is oogenesis? Give a brief account of oogenesis.

**Ans:** The process of formation of a mature female gamete (ovum) is called oogenesis. It occurs in the ovaries of female reproductive system. Oogenesis is a discontinuous process it begins before birth, stops in midprocess & only resumes after menarch. It occurs in three phases : Multiplicative phase (formation of oogonia mitotically from the primary germ cells), Growth phase (growth of oogonia into primary oocyte) & Maturation phase (formation of mature ova from primary oocyte through meiosis). Maturation phase produces two haploid cells – Larger one called secondary oocyte & the smaller one called polar bodies (1st polar body). Meiosis II of secondary oocyte results in the formation of functional egg or ovum and a second polar body: The first polar body may also divide to form two polar bodies of equal sizes which do not take part in reproduction & ultimately degenerates. First maturation division may be completed in the ovaries just prior to ovulation but second one (Final) is completed outside the ovary after fertilization. Secondary oocyte is female gamete in which the 1st meiotic division is completed & second meiotic division (Metaphase stage) has begin. The egg is released at secondary oocyte stage under the effect of LH.



**13. Draw a labelled diagram of a section through ovary.**



(d) Mature (graafian) follicle

**15. Name the functions of the following:**

- (a) Corpus luteum
- (b) Endometrium
- (c) Acrosome
- (d) Sperm tail
- (e) Fimbriae



**Ans:** (a) Corpus luteum : The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium.

(b) Endometrium is necessary for implantation of the fertilized ovum and other events of pregnancy.

(c) The acrosome is filled with enzymes that help during fertilization of the ovum.

(d) Sperm tail: Tail facilitates sperm motility which is essential for fertilization.

(e) Fimbriae: Fimbriae help in collection of the ovum after ovulation.

**16. Identify True/False statements. Correct each false statement to make it true.**

(a) Androgens are produced by Sertoli cells. (True/False)

(b) Spermatozoa get nutrition from Sertoli cells. (True/False)

(c) Leydig cells are found in ovary. (True/ False)

(d) Leydig cells synthesize androgens. (True/ False)

(e) Oogenesis takes place in corpus luteum. (True/False)

(i) Menstrual cycle ceases during pregnancy. (True/False)

(g) Presence or absence of hymen is not a reliable indicator of virginity or sexual – experience. (True/False)

**Ans:** (a) False, Androgens or male sex hormones (e.g, testosterone) are secreted by Leydig cells.

(b) True.

(c) False, Leydig cells are found in testis.

(d) True.

(e) False, Oogenesis takes place in ovary.

(f) True.

(g) True.

**17. What is menstrual cycle? Which hormones regulate menstrual cycle?**

**Ans:** Menstrual cycle is the cyclic change in the reproductive tract of primate female. This period is marked by a characteristic event repeated almost every month (28 days with minor variation) in the form of a menstrual flow (i.e. shedding of the endometrium of the uterus with bleeding. It may be temporarily stopped only in pregnancy.

The hormones that regulate menstrual cycles are

(i) FSH (Follicle stimulating hormone),

(ii) LH (Luteinizing hormone),

(iii) Oestrogens,

(iv) Progesterone.

**18. What is parturition ? Which hormones are involved in induction of parturition?**

**Solution:**

Parturition (or labour) means child birth. Parturition is the sequence of actions by which a baby and the afterbirth (placenta) are expelled from the uterus at childbirth. The process usually starts spontaneously about 280 days after conception, but it may be started by artificial means.

The process of parturition is induced by a complex neuroendocrine mechanisms involving cortisol, estrogen and oxytocin.

**19. In our society the women are often blamed for giving birth to daughters. Can you explain why this is not correct?**

**Ans:** The sex chromosome pattern in the human females is XX and that of male is XY. Therefore, all the haploid female gametes (ova) have the sex chromosome X, however, the haploid male gametes have either X or Y. Thus 50% of sperms carry the X-chromosome while the other 50% carry the Y-chromosome. After fusion of the male and female gametes, the zygote carries either XX or XY depending upon whether the sperm carrying X or Y fertilizes the ovum. The zygote carrying XX would be a female baby and XY would be a male baby. That is why it is correct to say that the sex of the baby is determined by the father.

**20. How many eggs are released by a human ovary in a month? How many eggs do you think would have been released if the mother gave birth to identical twins? Would your answer change if the twins born were fraternal?**

**Ans:** One egg is released by human ovary in a month. Identical twins: Identical twins are formed when a single fertilized egg splits into two genetically identical parts. The twins share the same DNA set, thus they may share many similar attributes. However, since physical appearance is influenced by environmental factors and not just genetics, identical twins can actually look very different.

Fraternal twins: These twins are formed when two fertilized eggs are formed. The twins share the different DNA set, thus they may share different attributes (dizygotic embryo).

**21. How many eggs do you think were released by the ovary of a female dog which gave birth to 6 puppies?**

**Ans:** Since dogs have multiple births, several eggs mature and are released at the same time. If fertilised, the egg will implant on the uterine wall. Dogs bear their litters roughly 9 weeks after fertilisation, although the length of gestation can vary from 56 to 72 days. An average litter consists of about six puppies, though this number may vary widely based on the breed of dog. On this basis 6 eggs were released by the ovary of a female dog which gave birth to 6 puppies.

## **Lesson 4 Reproductive Health**

### **Reproductive Health Problems and Strategies:**

**1. Reproductive health** simply refers to healthy reproductive organs with normal functions. According to the World Health Organisation (WHO), reproductive health means a total well-being in all aspects of reproduction, i.e. physical, emotional, behavioural and social.

**2. The improved reproductive health of society requires following factors:**

- (i) Better awareness about sex-related matters.
- (ii) Increased number of medically assisted deliveries and better postnatal care leading to decreased maternal and infant mortality rates.
- (iii) Increased number of couples with small families.

- (iv) Better detection and cure of STDs.
- (v) Overall increased medical facilities for all sex-related problems.

**3. Some of the measures taken for awareness of reproductive health are:**

(i) The family planning programmes were initiated in India in 1951 and were periodically assessed over the past decades. The programmes were improved and covered reproduction-related areas under the popular name Reproductive and Child Healthcare (RCH) programmes. It was launched in 1997.

Major tasks of RCH programme are:

- (a) Creating awareness among the people about reproduction related aspects.
- (b) Providing facilities and support for building up a reproductively healthy society.

Governmental and non-governmental agencies have taken various important steps to create awareness among people about reproduction-related aspects.

(ii) In schools, introducing sex education is a good step to provide right information for adolescents to discourage them from believing in myths and misconceptions about sex-related issues. Adolescents should be informed about reproductive organs, adolescence and related changes, safe and hygienic sexual practices, Sexually Transmitted Diseases (STDs), AIDS, etc.

(iii) Married couple or those in marriageable age group should be educated about available birth control options, care of pregnant mothers, postnatal care of the mother and child, importance of breast feeding, equal opportunities for the male and the female child, etc. This will lead to the formation of socially conscious healthy families of desired size.

(iv) Successful implementation of action plans like providing medical assistance and care to reproduction-related problems, pregnancy, delivery, STDs, abortions, contraception, menstrual problems, infertility, etc., needs strong support and infrastructural facilities.

(v) Statutory Ban on amniocentesis It is a prenatal diagnostic technique in which a sample of amniotic fluid is taken from the uterus of a pregnant women to detect the early development of foetus. The benefits of amniocentesis are the diagnosis of chromosomal abnormalities and developmental disorders of foetus. However, it is being misused for sex-determination of foetus that leads to female foeticides. Therefore, statutory ban on amniocentesis for sex determination keeps check on female foeticides.

**4. Population explosion** The tremendous increase in size and growth rate of population is called population explosion. It occurs due to increased health facilities and better living conditions.

(i) Reasons of population explosion are:

- (a) Decrease death rate.
- (b) Declined maternal mortality rate.
- (c) Decreased infant mortality rate.
- (d) Increase in number of people in reproductive age.

(ii) According to the 2001 census report, the population growth rate was around 1.7%, i.e. 17/1000/year. By this rate, our population could double in 33 years.

## **5. Methods to prevent population explosion are:**

- (i) Raising the marriageable age to 18 years for females and 21 years for males.
- (ii) Couples with small families should be given some incentives.
- (iii) Birth control is an important step to control the population growth by motivating smaller families to use contraceptive methods.

**6. Contraceptive methods** are ideal if they are used friendly, easily available, effective, reversible with no side effects and non-interfering with the sexual drive, desire and the sexual act.

There are several methods of birth control. These are categorised mainly as follow:

**(i) Natural method** of birth control involves avoiding chances of sperm and ovum meeting. It can be achieved by:

- (a) Periodic abstinence in which couples avoid coitus from day 10-17 (Fertile period) of the menstrual cycle. In this period, ovulation is expected to occur and chances of fertilisation are very high. Also called as rhythm method or natural family planning.
- (b) Coitus interruptus also called 'rejected sexual intercourse' or 'pull-out' method or withdrawal. In this method, the penis is withdrawn, from the vagina just before ejaculation.
- (c) Lactational amenorrhea refers to the absence of menstruation during the period of lactation following parturition. Because ovulation does not occur in this period, the chances of conception are none. This method is reliable for a maximum period of six months after delivery.

**ii) Barrier methods** are based on prevention of ovum and sperm from physically meeting with the help of barriers. Barriers may be chemical or mechanical.

- (a) Condoms are mechanical barriers made of thin rubber or latex sheath to cover the penis in male or vagina and cervix in females which prevent meeting of sperm and ova. Condoms also provides protection sexually transmitted diseases. They are disposable and can be self inserted and thereby gives privacy to the user.
- (b) Diaphragms, cervical caps and vaults are also mechanical barriers, made of rubber that are inserted into the female reproductive tract to cover cervix during coitus. They are reusable.
- (c) Spermicidal creams, jellies and foams are chemical barriers, usually used along with these barriers to increase their contraceptive efficiency.

**(iii) Intra Uterine Devices (IUDs)** are the devices introduced in the uterus through vagina by doctors or expert nurses. These are of following types:

- (a) Non-medicated IUDs, e.g. lippes loop.
- (b) Copper-releasing IUDs, e.g. Cu-T, Cu-7, multiload 375.
- (c) Hormone-releasing IUDs, e.g. progestasert, LNG 20.

IUDs prevent contraception in the following ways:

- (a) Increase phagocytosis of sperms within the uterus.
- (b) Some IUDs suppress sperm motility and fertilising ability of sperm by releasing copper ions.
- (c) The hormone releasing IUDs make uterus unsuitable for implantation and make the cervix

hostile to sperms.

IUDs are ideal contraceptives for females who want to delay pregnancy. It is one of most widely accepted contraception method in India.

**(iv) Oral contraceptives** are hormonal preparations in the form of pills.

(a) Pills are small doses of either progestogens or progesterone-estrogen combinations.

(b) Oral pills alter/inhibit ovulation and implantation and also modify the quality of cervical mucus to prevent/retard entry of sperms.

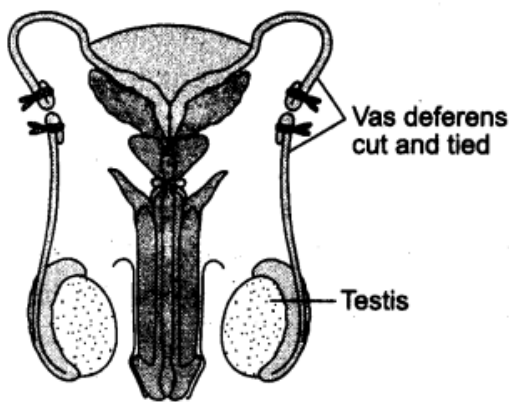
(c) Oral pills have to be taken daily for a period of 21 days starting within the first five days of menstrual cycle.

(d) Saheli an example of oral contraceptive developed by scientists at Central Drug Research Institute (CDRI) Lucknow, contains a non-steroid called centchroman. It is a once-a-week pill, with very few side effects.

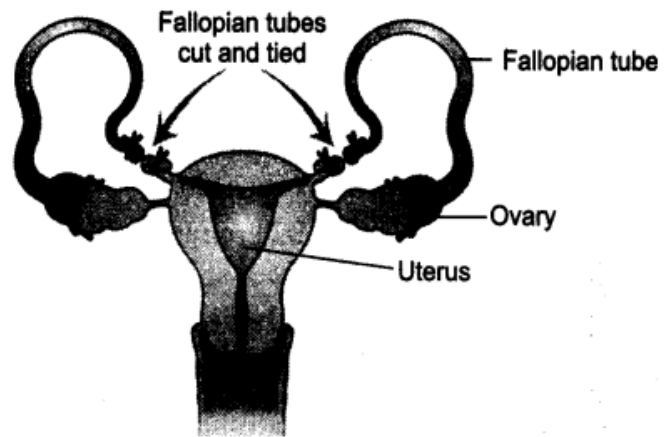
**v) Replants or injections** are effective for longer period, although their mode of action is similar to oral contraceptives. Progesterone alone or in combination with estrogen are used by females as injections or implants under the skin.

**vi) Emergency contraceptives** included administration of progesterone or progestogen oestrogen combinations or IUDs within 72 hours of coitus. It has been found to be very effective to avoid possible pregnancy due to rape or casual unprotected intercourse.

Both of these techniques are highly effective but poorly reversible.



Vasectomy in male



Tubectomy in female

**(6) Sterilisation or surgical methods** are used by male/female partner as a terminal method to prevent any more pregnancies. These methods blocks the transport of gametes and prevent contraception.

(a) **Vasectomy** is applied in case of males. In this method, a small portion of vas deferens is removed or tied up through an incision on the scrotum.

(b) **Tubectomy** is applied in females, where a small part of Fallopian tubes is removed or tied up through a small incision in the abdomen or through vagina.

(7) **Medical Termination of Pregnancy (MTP)** or induced abortion is intentional or voluntary termination of pregnancy before full term.

(a) The Government of India had legalised MTP in 1971 with some strict conditions to avoid its misuse. These are important to check indiscriminate and illegal female foeticides which are reported to be high in India.

(b) MTPs are done in certain cases where pregnancy can be harmful and even fatal either to the mother or the foetus or both, or duets failure of contraceptive used during coitus or rapes.

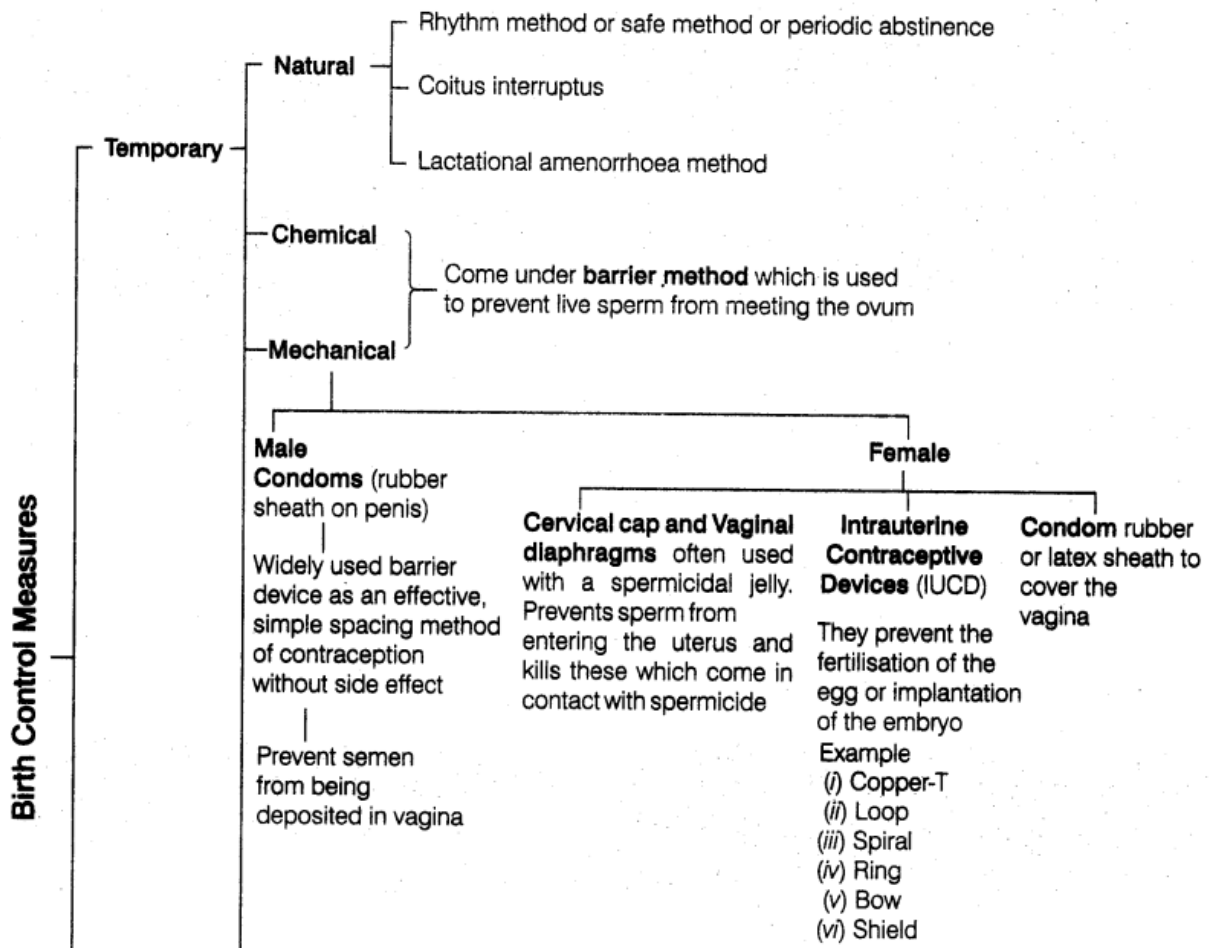
(c) MTPs are considered relatively safe during the first trimester (upto 12 weeks) of pregnancy.

d) During second trimester, MTPs are unsafe and could be fatal too.

(e) About 45-50 million MTPs are carried out in a year all over the world. It has significant role in decreasing population though it is not meant for that purpose.

## Reproductive Health

The birth control measures can be summarised as follows:



## **I Multiple choice questions**

Question 1.

Which of the following is ART?

- (a) IUDs
- (b) GIFT
- (c) ZIFT
- (d) Both (b) & (c)

Answer:

- (d) Both (b) & (c)

Question 2.

The technique called Gamete Intra Fallopian Transfer (GIFT) is recommended for those females

- (a) who cannot produce an ovum
- (b) who cannot retain the foetus inside uterus
- (c) who cannot provide suitable environment for fertilisation
- (d) all of these

Answer:

- (a) who cannot produce an ovum

Question 3.

Which method can be used for women that cannot produce ovum but can provide suitable environment ?

- (a) IUD
- (b) GIFT
- (c) IUI
- (d) ICSI

Answer:

- (b) GIFT

Question 4.

Which of these can be used to cure infertility in couples where male partner has very low sperm count ?

- (a) IUD
- (b) GIFT
- (c) IUI
- (d) None of these

Answer:

- (c) IUI

Question 5.

The method of directly injecting a sperm into ovum in assisted reproductive technology is called

- (a) GIFT
- (b) ZIFT
- (c) ICSI
- (d) ET

Answer:

- (c) ICSI

Question 6.

Increased IMR and decreased MMR in a population will

- (a) cause rapid increase in growth rate
- (b) result in decline in growth rate
- (c) not cause significant change in growth rate
- (d) result in an explosive population.

Answer:

- (b) result in decline in growth rate

Question 7.

Intensely lactating mothers do not generally conceive due to the

- (a) suppression of gonadotropins
- (b) hypersecretion of gonadotropins .
- (c) suppression of gametic transport
- (d) suppression of fertilisation.

Answer:

- (a) suppression of gonadotropins

Question 8.

A national level approach to build up a reproductively healthy society was taken up in our country in

- (a) 1950s
- (b) 1960s
- (c) 1980s
- (d) 1990s

Answer:

- (a) 1950s

Question 9.

Emergency contraceptives are effective if used within,

- (a) 72 hrs of coitus
- (b) 72 hrs of ovulation
- (c) 72 hrs of menstruation
- (d) 72 hrs of implantation.



Answer:

(a) 72 hrs of coitus

Question 10.

From the sexually transmitted diseases mentioned below, identify the one which does not specifically affect the sex organs.

- (a) Syphilis
- (b) AIDS
- (c) Gonorrhoea
- (d) Genital warts

Answer:

(b) AIDS

**Answer the following questions:**

**1. What do you think is the significance of reproductive health in a society?**

**Ans:** Reproductive health in a society is significant because the people are aware of

- (i) birth control methods and advantages of small family,
- (ii) sexually transmitted diseases and methods to avoid them,
- (iii) importance breast feeding and post natal care of the mother and baby and
- (iv) equal opportunities for the male and female children

**2. Suggest the aspects of reproductive health which need to be given special attention in the present scenario.**

**Ans:** The aspects of reproductive health which need to be given special attention are :

- Introduction of sex education in schools to give right information to the young minds about reproductive organs, accessory organs of reproduction, secondary sexual characters, adolescence and related changes, safe and hygienic sexual practices, STDs etc.
- Providing knowledge about available birth control methods, care of pregnant mothers, post-natal care of the mother and child, importance of breast feeding etc.
- Creating awareness about consequences of uncontrolled population growth and social evils (sex abuses and sex-related crimes, use of drugs, tobacco and alcohol etc.) among young people.

**3 Is sex education necessary in schools? Why?**

**Ans:** Yes, sex education is necessary in school. Because introduction of sex education in school encourage to provide the right or correct information to the young peoples so as to discourage children from believing in myths & having misconceptions about sex related aspects. Proper information about reproductive organs, safe & hygienic sexual practices, STD's etc. would help people, those in the adolescent age group to lead a healthy reproductive life. In many countries, sexual education raises much contentious debate. Chief among the controversial points is whether covering child sexuality is valuable or detrimental; the use of birth control such as

condoms and hormonal contraception, and the impact of such use on pregnancy, outside marriage, teenage pregnancy, and the transmission of STDs. Increasing support for abstinence – only sex education by conservative groups has been one of the primary causes of the controversies.

**.4 Do you think that reproductive health in our country has improved in the past 50 years? If yes, mention some such areas of improvement**

**Ans:** Yes, in the last 50 years, reproductive health in our country has improved. Some such areas of improvement are (i) massive child immunization (ii) maternity and child health (iii) increasing use of contraceptives (iv) family planning.

Bringing sexual and reproductive health services to the millions of people living in countries which still suffer from short life expectancies, high levels of child and maternal mortality, child ISS&ur and illiteracy and poor overall health remains a major challenge for governments and non government organizations.

**5. What are the suggested reasons for population explosion?**

**Ans:** (i) Increased health facilities along with better living conditions had an explosive impact on the growth of population.

(ii) Decline in Death rate

(iii) Decline in Maternal Mortality Rate

(iv) Decline in Infant Mortality Rate

(v) Increase in the number of people in the reproductive age.

**6 Is the use of contraceptives justified ? Give reasons.**

**Ans:** Population in India is increasing at a very fast rate and such a growth necessitated intense use of contraceptive methods to bring all the fertile couples under its cover. It will help in bringing the birth rate down and consequently check the population growth. Therefore, the use of contraceptives is justified. It is essential to mention here that the selection of a suitable contraceptive method should be practiced in consultation with qualified doctors. The government provides these facilities free at the family planning centres. Contraceptives are given free or at nominal prices at these centres to the couples of reproductive age desirous of preventing conception.

**7. Removal of gonads cannot be considered as a contraceptive option. Why?**

**Ans:** Removal of gonads or its parts is a surgical method, of sterilization. Vasectomy and tubectomy are carried out in males and females respectively. It will lead to infertility & both male and female will be dependent on hormones in their remaining life to regulate functioning of reproductive organs. These are very effective but their irreversibility is very poor, so they are not good options for contraception.

**8. Amniocentesis for sex determination is banned? in our country. Is this ban necessary? Comment**

**Ans:** Since Amniocentesis is misused to find out the sex of the foetus leading to female foeticides, it is necessary. It is the prenatal diagnostic

technique, that helps to find out chromosomal (genetic) disorders, metabolic disorders of the foetus; in extreme cases where the foetus is found to be suffering from an incurable disorder Medical Termination of Pregnancy (MTP) is banned. The solution to the problem is not ' passing more laws, such as banning sex determination ultrasounds but raising the social & economic status of women,

**9. Suggest some methods to assist infertile couples to have children.**

**Ans:** ART (Assisted Reproductive Technologies) is a term that describes several different methods used to help infertile couples. ART involves removing eggs from a woman's body, mixing them with sperm in the laboratory and putting the embryos back into a woman's body. Success rates vary depending on many factors. Something that affects the success rate of ART includes age of the partners, reason for infertility, type of ART, if the egg is fresh or frozen. Various methods are now available to help such couples are — in vitro fertilization, gamete intra fallopian transfer, intracytoplasmic sperm injection & artificial insemination.

- (i) **In vitro fertilization** – Patient's egg & her partner's sperm are collected & mixed together in a laboratory to achieve fertilization outside the body. The embryo produced may then be transferred into the female patient. It is commonly known as test tube baby programme.
- (ii) **Gamete Intra Fallopian Transfer (GIFT)** – A procedure in which eggs are retrieved from a woman, mixed with sperm & immediately replaced in one or other of the woman's fallopian tubes so that they fertilize inside the body (in vivo).
- (iii) **Intra Cytoplasmic Sperm Injection (ICSI)**– In this method, sperm & eggs are retrieved from both the parents. A single sperm is injected directly into an egg, then the fertilized egg is implanted into the woman's uterus.
- (iv) **Artificial insemination** – In this technique, the semen is collected either from husband or a healthy donor & is artificially introduced either into the vagina or into the uterus of the female (IUI-Intra uterine insemination).

**10. What are the measures one has to take to prevent from contracting STDs?**

- Ans:**
- (i) Avoiding sex with unknown partner /multiple partners.
  - (ii) Always use condoms during intercourse.
  - (iii) In case of doubt, go for medical professional for early detection and get complete treatment if diagnosed with disease.
  - (iv) Education & counselling of persons at risk on ways to adopt safer sexual behaviour.

**11. State True/False with explanation**

- (a) **Abortions could happen spontaneously too. (True/False)**
- (b) **Infertility is defined as the inability to produce a viable offspring and is always due to abnormalities/defects in the female partner. (True/False)**
- (c) **Complete lactation could help as a natural method of contraception. (True/False)**
- (d) **Creating awareness about sex related aspects is an effective method to improve reproductive health of the people. (True/False)**

**Ans:** (a) True. Due to internal factors like incompatibility, abortion could happen spontaneously.  
(b) False. It is due to abnormalities/defects in either male or female or both the partners.  
(c) True, but it is limited to period up to six months after parturition.  
(d) True. Creating awareness about sex-related aspects removes the myths and misconceptions about these problems.

**12. Correct the following statements:**

**(a) Surgical methods of contraception prevent gamete formation.**

**(b) All sexually transmitted diseases are completely curable.**

**(c) Oral pills are very popular contraceptives, among the rural women.**

**(d) In E.T. techniques, embryos are always transferred into the uterus.**

**Ans:** (a) Surgical methods of contraception prevent gamete transport & thereby prevent b) Except for hepatitis-B, genital herpes, and HIV infections, other STD diseases are completely curable if detected early and treated properly.

(c) Oral pill are very popular contraceptives among the educated urban women.

(d) In E.T. techniques, embryos with 8 blastomeres are transferred into fallopian tube and more than 8 blastomeres are transferred into the uterus. conception.