

## REPRODUCTION

### 11.1 MEANING OF REPRODUCTION :

Reproduction is the ability of living organisms to produce new living organisms similar to them. It is one of the important characteristic of life.

#### 11.1 (a) Purpose of Reproduction :

Reproduction is aimed at multiplication and perpetuation (stability) of the species. In other words it proves group immortality by replacing the dead individuals with new ones.

#### 11.1 (b) Basic Features of Reproduction :

The modes of reproduction vary in different organisms. However all of these have certain common basic features. These are -

(i) replication of DNA

(ii) cell division

(iii) Formation of reproductive bodies or units

(iv) development of reproductive bodies into offspring

### 11.2 FORMS OF REPRODUCTION :

Animals reproduce in a variety of ways. Which are categorized in two categories i.e. Asexual and sexual reproduction.

#### 11.2 (a) Asexual Reproduction :

**Definition :** Production of offspring by a single parent without the formation and fusion of gametes is called as **asexual reproduction**. It is more primitive type of reproduction. It ensures rapid increase in number.

**Occurrence :** Asexual reproduction occurs in protozoans and some animals such as sponges, coelenterates, certain worms and tunicates. It is absent among the higher invertebrates and all vertebrates.

**Type of Asexual Reproduction:** Asexual reproduction takes place in the following principal ways :

(i) **Fission** : it is the simplest form of reproduction in which unicellular organism either divides into two or many organisms.

**It is also divided into two types :** (A) **Binary fission** : It is a type of reproduction in which nuclear division is followed by the appearance of a constriction in the cell membrane, which gradually deepens inward and divides the cytoplasm into two parts, each with one nucleus. Finally two daughter cells are formed.

e.g. **Amoeba**

(B) **Multiple fission** : Sometimes the nucleus several times into many daughter nuclei. The daughter nuclei arrange at the periphery of the parent cell, and a bit of cytoplasm around each daughter nucleus is

present. nucleus develops an outer membrane. Finally the multinucleated body divides into many daughter cells. **e.g. Plasmodium.**

(ii) **Budding** : Formation of daughter individual from a small projection which is called as bud, arising on the parent body is called as budding.

**Budding is also of two types :**(A) **Exogenous budding** : [External budding] In this, bud arises from the surface of parent body, **e.g., Hydra.** (B) **Endogenous budding** : [Internal budding] In this, bud arises inside or within the parent body **e.g., Sponges.**

**NOTE** : During the process of budding, the bud remains attached to the parent body so as to derive it's nutrition from the parent but as it matures, it get's detached form the parent body.

(iii) **Fragmentation** : It is a type reproduction or the regeneration ability of the organisms to replace their lost part. In this process an entire new organism can grow from certain pieces or cells of the parent organisms. **e.g. Flatworm.**

(iv) **Spore formation** : It is a process of reproduction most commonly found in fungi, some cocci and bacillus bacteria. During this process a structure called as **sporangium** is formed. In this structure nucleus divides several times and each nucleus with a little trace of cytoplasm forms a **spore**. These spores are then liberated out and develop into a new hyphen, e.g. **Rhizopus.**

(v) **Vegetative propagation** : This is a type of reproduction found in higher plants in which a new plant is formed from vegetative part of the plant such as roots, stems or leaves.

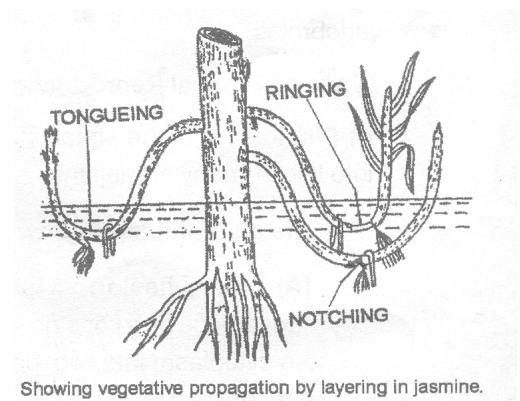
**It is of following types :**

(A) **Cutting** : This is the very common method of vegetative propagation practised by the gardeners all over the world. It is the process in which a vegetative portion from plant is taken and is rooted in the soil to form a new plant **e.g. Grapes, Sugarcane** etc.

(B) **Layering** : In this process the development of adventitious roots is induced on a stem before it gets detached from parent plant, e.g, Mango, **roses** etc.

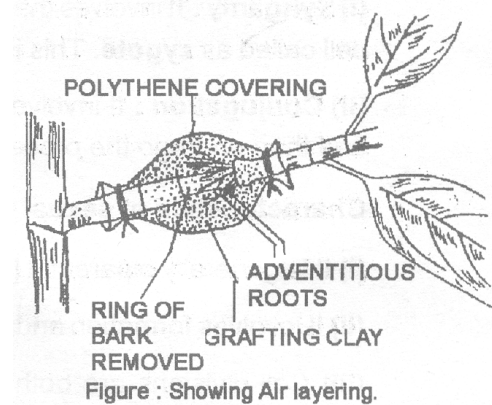
**It is of three types :**

- **Mound layering** : In the process of layering the lower stem branch of plant is used. Leaves are removed from this stem. Then it is bent close to the ground, pegged and covered with the moist soil in such a way that it's rowing tip remains above the solid surface. This pegged down branch is called as **layer**. After a few days the covered portion of stem develops roots. This stem is then detached from the parent plant and is grown separately from the parent plant and is grown separately into a new individual **.e.g Jasmine**



**NOTE** : The formation of adventitious roots in a layer can be hastened by injuring the 'layer' by tonguing, ringing or notching.

- **Air layering** : It is adopted in those plants where stem cannot be bent to the ground. In this process the stem is **girdled** (i.e. ring of the bark is removed), then it is covered with moist moss or cotton and wrapped with a polythene sheet to preserve the moisture. After few weeks adventitious roots develop from the injured part. The branch along with roots is then separated from the parent plant and planted to grow into a new plant. e.g. **Orange, Pomegranate** etc.



- **Grafting** : The process of joining together of two different plants in such a manner that they live as one plant is called as **grafting**. Out of the two plants one is rooted in the soil and is known as the **stock**. The other part consists of a small shoot bearing one or more buds, it is known as **scion**. Their union is carried out in such a way that their cambium must overlap each other e.g. **Mango, roses** etc.

(vi) **Micro propagation** : It has now become possible due to recent techniques to produce a large number of plantlets from a small piece of tissue taken from the shoot tip or other suitable plant parts. This method of propagation is called as **micropropagation**. It involves the process of **tissue culture**. e.g., **Orchids, ornamental plants** etc.

- **Significance of vegetative propagation**

(A) It is used to propagate a plant in which viable seeds are not formed or very few seeds are produced e.g. **Orange, pineapple, banana** etc.

(B) Vegetative propagation helps us to introduce plants in new areas where the seed germination fails to produce mature plant due to change in environmental factors and the soil.

(C) Vegetative propagation is a more rapid, easier and cheaper method of multiplication of plants.

(D) By this method a good quality of a race or variety can be preserved.

(E) Most of the ornamental plants are propagated through vegetative propagation. e.g. **Rose, Tulip** etc.

(vii) **Parthenogenesis** : It is a modification of sexual reproduction in which an egg develops into a complete offspring without fertilization. It is monoparental (i.e. fusion of gametes does not occur, only a single parent gives rise to a new individual).

- **Significance of asexual reproduction** : It brings about multiplication of the species only. It does not play a role in evolution as no variation is introduced into the new individual formed by it.

## 11.2 (b) Sexual Reproduction :

- **Definition** : Production of offspring by formation and fusion of special haploid cells called as gametes. These are contributed generally by two parents. i.e. **male gamete** and **female gamete** is called as **sexual reproduction**.

- **Occurrence**: Sexual reproduction occurs nearly in all animals including those which reproduce asexually. In most animals there are two sexes male and female, and the differences between them are genetically determined.

## Types of sexual reproduction :

(i) **Syngamy** : It involves the complete and permanent fusion of two gametes to form a composite cell called as **zygote**. This is a common mode of sexual reproduction.

(ii) **Conjugation** : It involved temporary pairing of two parents which exchange their pronuclei and then undergo the process of separation .e.g **Paramecium** etc.

### • Characteristics of sexual reproduction :

(i) It is generally biparental [i.e. it involves two parents ]

(ii) It involves formation and fusion of gametes.

(iii) Cell divisions are both **meiotic & mitotic** during gamete formation and **mitotic** during development of zygote into an offspring.

(iv) The offspring's are not genetically identical to the parents.

(v) Fertilization in case of humans is internal.

(vi) Infants can be fed on mother's milk.

(vii) Parental care is very well developed,

### • Significance of sexual reproduction :

(i) It results in multiplication and perpetuation of species.

(ii) It contributes to evolution of the species by introducing variation in a population much more rapidly than asexual reproduction.

### • General Terms :

(i) **Fertilization** : It is the process of fusion of gametes.

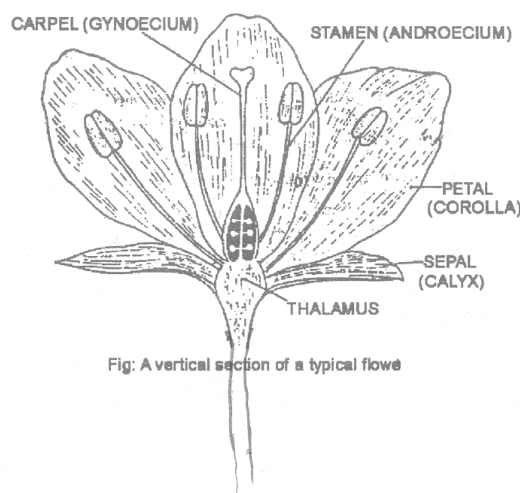
(ii) **Unisexual organism** : In case of humans male and female sex organs are separate and therefore called as unisexual.

(iii) **Bisexual** : In plants and some organisms like tapeworm, earthworm etc. both male and female organs are present in the same individual and therefore called as bisexual.

(iv) **Gonads**: Organs which are involved in the formation of gametes are called as gonads.

(v) **Copulation or mating** : The process of transfer of male gametes into female body.

## 11.3 REPRODUCTION IN A FLOWERING PLANT :



### 11.3 (a) A flower Consists of Following Parts :

- (i) **Calyx:** The sepals collectively are called as calyx. They are usually green in colour and protect the inner whorls of a flower especially during bud formation.
- (ii) **Corolla :** It consists of coloured petals. They are normally large often fragrant and bright coloured. Their primary function is to attract animals and insects for pollination.
- (iii) **Androecium / stamen/male reproductive organ :** The stamens are referred to as the male reproductive organ. A typical stamen is differentiated into three parts, they are **filament** **connective** and **anther**.

**(A) Filament :** It forms the stalk that bears more or less cylindrical or avoid anther.

**(B) Connective :** It connects anther to filament.

**(C) Anther :** It is present on the top of filament. Each anther consists of two lobes that is why it is called as bilobed. Bed anther lobe has **two pollen sacs** which contain millions of tiny microscopic grains, called as **microspores**. The pollen grains are like yellow dusty powder in appearance.

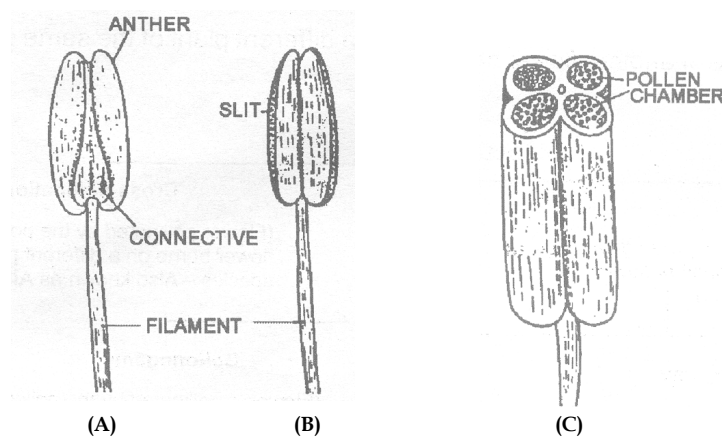


Fig. : (A) , entral view showing connective  
(B) dorsal view  
(C) t.s. of fanther showing pollen chambers

### (vi) Gynoecium / pistil / female reproductive organ :

- It is located in the center of a flower.
- It is composed of one or more carpals.
- The freely occurring units of the carpals in a flower are called **pistils**.
- Each pistil usually consist of three distinct parts - ovary, style and stigma.

**(A) Ovary :** It is a basal, swollen part of the pistil The ovary has one or more chambers called the **loculi** which is distributed in a special cushion like parenchymatous tissue called the **placenta**, from which the ovule develops.

**(B) Style :** From the top of the ovary arises a long, elongated structure called as **style**.

**(C) Stigma :** The terminal end of style is called as **stigma**. The stigma is normally rough, hairy or sticky to hold pollen grains during pollination process.

### 11.3 (b) Pollination :

The transfer and deposition of pollen grains from the anther to the stigma of a flower is called as pollination.

- **Types of pollination :** Pollination is of two type -

(i) **self pollination :** It is the process of transfer of the pollen grains from the anther to the stigma of either the same or genetically similar flower. It is further divided into two types :

(A) **Autogamy:** It is a type of self pollination in which the pollen grains are transferred from the anther to stigma of the same flower **e.g. Wheat, rice pea** etc.

(B) **Geitonogamy :** It is a type of self pollination in which the pollen grains are transferred from the anthers of one flower to the stigma of another flower borne either on the same plant or a genetically identical plant.

- **Significance of self pollination :**

- It maintains purity of race.

- It also maintains the superiority of variety once developed.

(ii) **Cross pollination :** it is the process of transfer of the pollen grains from the anther of one flower to the stigma of another flower borne on a different plant of the same species.

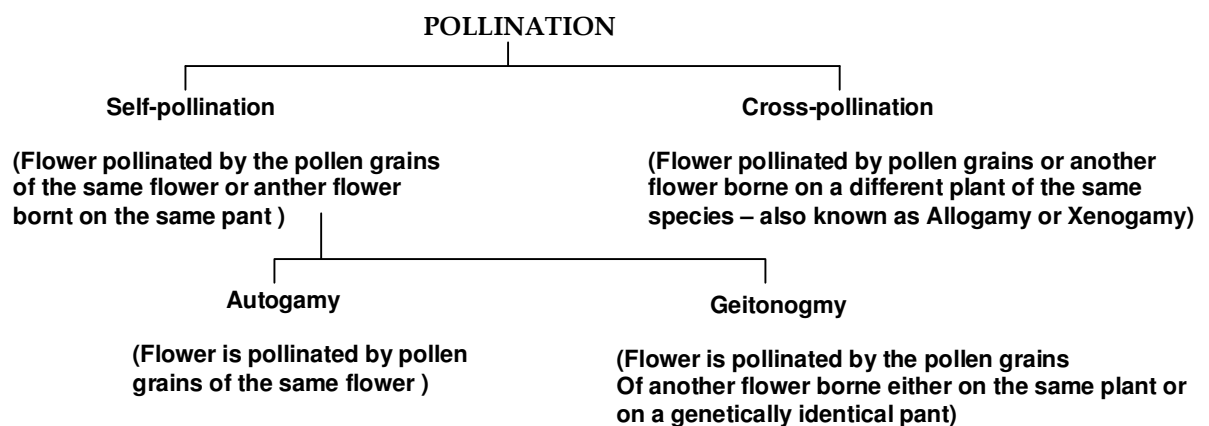


Fig : Flow diagram showing the types of pollination

- The transfer of pollen grains occurs through various ways, which may be **biotic** or **abiotic**.

(i) **Abiotic factors**

Wind

Water

**Technical terms**

Anemophily

Hydrophily

(ii) **Biotic factors**

Insects

Birds

Bats

Snails

Entomophily

Ornithophily

Chiropterophily

Malacophily.

- **Significance of cross pollination :**

(i) Increase in yield and adaptability.

(ii) It eliminates defective traits and produces new varieties.

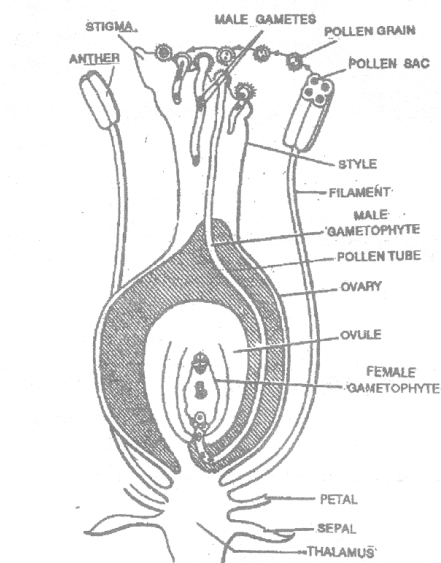
(iii) It also leads to the hybrid production.

### 11.3 (c) Fertilization in a Flowering Plant :

- Fertilization is a process of fusion of male gamete with the female gamete.
- The process of formation of male gametophyte in case of plants is called as **microsporogenesis**.
- The process of formation of female gametophyte in case of plants is called as **megasporogenesis**.
- The process of pollination occurs, due to which the anther gets stuck up to the stigma.
- After reaching to stigma pollen grains develop a pollen tube.
- This pollen tube grows through the length of style, from where it reaches to ovule.
- Pollen tube comprises of two male gametes, which is later on released in the **embryo sac** through an opening called as **micropyle**.
- Here one male gamete fuses with the egg to form a **diploid zygote** and the other male gamete fuses with the polar bodies to form a **triploid nucleus** which later on produces the structure called as **endosperm**.
- The process of fusion of one of the male gametes with egg and the other male gamete with polar bodies is called as **"double fertilization."**
- The fusion of one male gamete with the two polar bodies to form endosperm is called a **"triple fusion"** (at it involves one male gamete and two polar bodies).

**NOTE :** The endosperm is meant to provide nourishment to the developing embryo.

- After fertilization sepals and petals fall and zygote undergoes a series of mitotic divisions to form a multinuclear embryo.
- At maturity wall of ovules changes to **seed coat** of which outer one is hard and is known as **testa**, while inner one is called as **tegmen**.
- **Ovules change into seed and ovary wall changes into fruit wall.**



**FIG: SHOWING FERTILIZATION IN A FLOWER**

DIFFERENCES BETWEEN SELF POLLINATION AND CROSS POLLINATION		
S.NO.	SELF POLLINATION	CROSS POLLINATION
1.	Pollen grains are transferred from the anther to the stigma of the same flower (autogamy) or another flower on the same plant (geitonogamy)	Pollen grains are transferred from the anther of one flower to the stigma of another flower borne on a different plant of the same species (allogamy).
2.	Both the anther and stigma mature at the same time.	The anther and stigma of a flower generally mature at different times.
3.	It can occur even when the flowers are closed	It occurs only when the flowers are open.
4.	External agent is not required for self-pollination.	An external agent abiotic or biotic, is essential for cross-pollination
5.	It is economical for the plant.	Cross-pollination is not economical as the plant has to produce a lot of pollen grains, nectar, scent and bright-coloured corollas etc.
6.	Self-pollination ultimately results in progenies which are pure lines i.e. homozygous.	Cross-pollination produces the offspring which are hybrids i.e., heterozygous. They show variations in characteristics.
7.	It cannot eliminate useless or harmful characters.	It can eliminate useless or harmful characters.
8.	Highly useful characters get preserved in the race.	Useful characters cannot be preserved in the progenies.
9.	Self-pollination does not introduce any variations and hence the offspring are unable to adapt to the changed environment.	Cross-pollination introduces variations in the offsprings. These variations make these plants adapt better to the changed environment for the struggle for existence.
10.	Immunity of the race towards disease falls in the succeeding progenies.	Immunity of the race towards disease is usually maintained in the succeeding progenies.
11.	Yield of the plant gradually falls with time.	Yield of the plant usually does not fall.
12.	Self-pollination never helps in the production of new varieties and species.	Cross-pollination is a mechanism of producing new varieties and species among plants.



## OBJECTIVE QUESTIONS

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1. Cleistogamous condition is present in  
(A) Brassica oleracea                      (B) Solanum tuberosum                      (C) Arachis hypogea                      (D) Allium cepa
2. Which of the following regenerated with the help of layering?  
(A) Cactus                      (B) Rose                      (C) Mango                      (D) Jasmine
3. Development of egg without fertilization is  
(A) parthenocarpy                      (B) polyembryo  
(C) parthenogenesis                      (D) adventive embryony
4. Anemophily is pollination by  
(A) air                      (B) water                      (C) insects                      (D) animal
5. Pollination between different flowers of same plant is called  
(A) autogamy                      (B) geitonogamy                      (C) allogamy                      (D) xenogamy
6. Double fertilization is  
(A) fusion of two male gametes with egg  
(B) fusion of one male gamete with egg and the other male gamete with the polar bodies  
(C) both are correct  
(D) both are incorrect
7. The structure meant for the nourishment of developing embryo in case of plant is  
(A) pollen tube                      (B) endosperm  
(C) both A & B are correct                      (D) none of these
8. The embryo sac of a typical dicot at the time of fertilization is -  
(A) 8 celled                      (B) 7 celled                      (C) 6 celled                      (D) 5 celled
9. The genetic information is stored in -  
(A) DNA                      (B) RNA                      (C) Ribosome                      (D) ER
10. Each female flower consist of  
(A) ovary                      (B) stigma  
(C) ovary, style and stigma                      (D) thalamus

## **SUBJECTIVE QUESTIONS**

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### **VERY SHORT ANSWER TYPE QUESTIONS**

1. What is reproduction ?
2. What is the basic requirement of sexual reproduction ?
3. What is the difference between binary and multiple fission ?
4. What is a spore ?

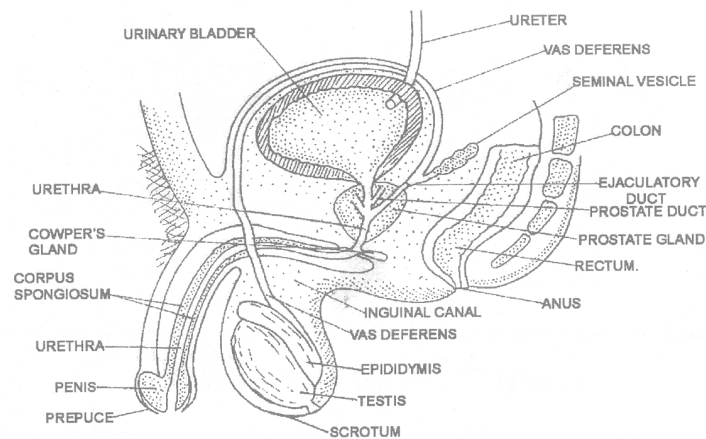
### **LONG ANSWER TYPE QUESTIONS**

6. What is budding ? mention it's types.
7. What are accessory sex organs ?
8. What is gonad and what are it's functions ?
9. Define implantation.
10. Differentiate between vas deferens and vasa efferentia.

## 12.1 SEXUAL REPRODUCTION IN HUMANS :

- Mammals are unisexual.
- Reproductive system of each organism consists of many reproductive organs.
- These can be primary sex organs or secondary sex organs.
- The **primary sex organs** are called as **gonads**. They produce sex cells or **gametes** and also secrete sex hormones.
- The gonads of males are called a **testis**, which produce **sperms**.
- The gonads of females are called as **ovaries**, which produce **ova or female gametes**.
- **Secondary sex organs** include the reproductive ducts which transport gametes and reproductive glands which help in process of reproduction. These organs do not produce gametes.
- **e.g., In males :** Vasa efferentia, epididymis, seminal vesicles, ejaculatory duct, urethra etc. **In females :** Fallopian tube, uterus, vagina, mammary glands etc.
- **Accessory or external sex characters** help to distinguish the two sexes of a species externally.
- **e.g., In male :** Muscular body, more height, low pitched voice, moustaches etc.  
**In female :** High pitched voice, breast development, lateral pubic hairs etc.
- **Puberty :** Beginning of sexual maturity is known as **puberty**.
- At this stage primary sex organs start functioning.
- Secondary sex organs develop dully under the influence of sex hormones produced by primary sex organs.
- In the stage of puberty body growth is very rapid.
- It occurs at the age of **10 - 14 years in girls** and **13 - 15 years in boys**.

### 12.1 (a) Male Reproductive System :



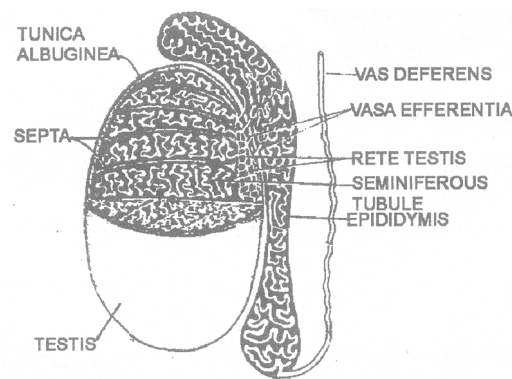
**Fig : Male reproductive system.**

- **Male reproductive system comprises of following parts :**

- |                 |                             |                       |
|-----------------|-----------------------------|-----------------------|
| (i) Testis      | (ii) Scrotum                | (iii) Vasa efferent   |
| (iv) Epididymis | (v) Vas deference           | (vi) Ejaculatory duct |
| (vii) Urethra   | (viii) Accessory sex glands | (ix) Penis            |

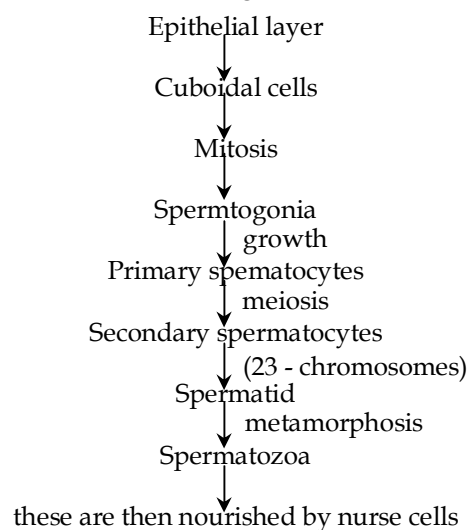
#### (i) Testis :

- They are soft, smooth, pinkish, oval organs. They are housed [present] in a sac like structure called as **scrotum**. **Outer** covering is called as **tunicavaginalis**.
- It's inner covering is called as **tunica albuginea**.
- Ingrowths of tunica albuginea are called as **septa**, that divide the testis into 200-300 lobules.



**Fig : Longitudinal section of mammalian testis .**

- It also consist of convoluted somniferous tubules.
- These somniferous tubules at one end join to form tubules which open into a network of irregular cavities known as **rete testis**.
- This rete testis comes out from a dorsal surface of the testis with the help of **vesa efferentia**. This vasa efferentia combines to form a single tube which becomes highly coiled and from **epididymis**.
- This vasa efferentia combines to form a single tube wihich becomes highly coiled and form **epididymis**.
- Epididymis peon into a narrow tube **vas deferens**.
- **Somniferous tubules** from the spermatogenic tissue of the testis.
- It consists of a germinal epithelial layer at the periphery. Spermatogenesis occurs at the center.
- It forms spermatogonia which grows and form spermatocytes which further grow to form **primary spematrocytes**, which undergo meiosis to form **secondary spermatocytes** and then **spematids**.
- The later (i.e. spermatids) metamorphose into **spermatozoa**.
- This process of formation of spermatozoa from spermatogonia is called as **spermatogenesis**.
- These spermatozoa are nourished during the development by nurse cells.



**Flow chart showing the process of Spermatogenesis**

- In between seminiferous tubules, there are interstitial cells known as **Leydig cells** which secrete male hormone called as **testosterone**. This hormone helps in the growth and development of male sex hormone.

(ii) **Scrotum** : It is a pouch of pigmented skin arising from the lower abdominal wall and hanging between the legs.

- It is divided internally into two compartments by a muscular partition called as **septum scroti**.
- Scrotum possesses smooth involuntary **dartos muscles**.
- Scrotum sac is connected to the abdominal cavity through **inguinal canal**.
- Function of dartos muscle is to change the position of testis to keep them at proper temperature.
- Scrotum has temperature 1 - 3 lower than body temperature which favours the formation of sperms.
- **Duct system** :

(iii) **Vasa efferentia** : Rete testis is connected to epididymis through a fine tubule called as **vasa efferentia**. They help in conduction of sperms.

(iv) **Epididymis** : They are long tubules which lie compacted along the testis from their upper ends to lower back side. Its walls are muscular and glandular to provide or secrete nutritive fluid which provides nourishment to the sperms.

(v) **Vas deference** :

- Vasa efferentia from epididymal duct finally opens into vas deferens.
- It comes out through inguinal canal passing over urinary bladder to receive ducts from seminal vesicles.
- They are thick walled and muscular and conduct sperms.

(vi) **Ejaculatory duct** : They are short, straight, muscular tubes, each formed by the union of vas deferens and duct of seminal vesicles.

(vii) **Urethra** : it arises from urinary bladder forming a urinogenital canal. It carries urine, sperm and secretion of seminal vesicles, prostate and Cowper's gland.

(vii) **Accessory glands**: They consist of prostate gland, a pair of seminal vesicles, and a pair of Cowper's gland.

(A) **Prostate gland** : It is a large pyramidal gland that encloses a part of urethra including its junction with the ejaculatory duct. It contains 30 - 40 alveoli which open separately into urethra by fine ducts. Secretion is thick, milky and alkaline which constitute 20 - 30% semen.

(B) **Cowper's glands** " These are a pair of small glands, present below the prostate and consist of separate opening. Their secretion provide lubrication to the reproductive track.

(C) **Seminal vesicle** : It is paired and present between urinary bladder and rectum. Its secretion forms a major part of semen (60-70%). It is thick, viscous, alkaline having proteins, fructose and prostaglandins.

(ix) **Penis** : It is a male copulatory organ which also passes urine. It consists of highly sensitive covering of skin called **prepuce**.

## 12.1 (b) Semen :

It is milky, viscous and alkaline fluid, ejaculated by reproductive system of males during copulation

- Its quantity is 2.5 - 4.0 ml at a time having about 40 million sperms.

- Semen has chemical for nourishment of sperms neutralizing the acidity of urethra and vagina, stimulating their movement in female tract.
- **Spermatogenesis** starts at puberty under the influence of **gonadotropin** secreted from **anterior pituitary gland**.

### 12.1 (c) Structure of Sperm :

Each sperm consists of following parts :

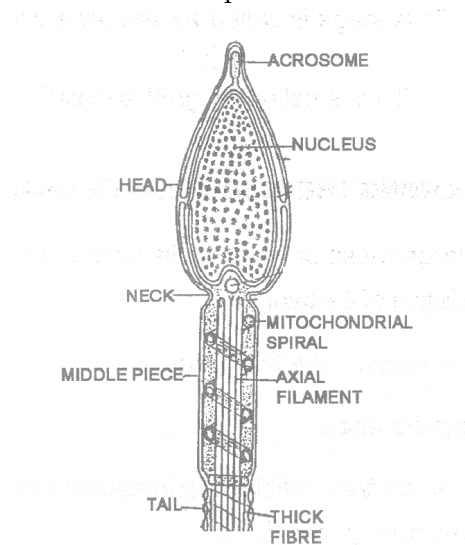
- (i) Head (ii) Neck (iii) Middle piece (iv) Tail

**(i) Head :** It is oval in structure. It is composed of a large nucleus and a small **acrosome**. The nucleus is compact. It consists of DNA and basic proteins. Acrosome lies at the tip of nucleus. It is formed of golgi complex. It consist of hydrolytic enzymes and is used to contact and penetrate the egg during fertilization.

**(ii) Middle piece:** It is cylindrical in human sperms. It consists of ATP and mitochondria in a thin layer of cytoplasm. Mitochondria is coiled round the axial filament, it provided energy and it is said to be the **power house of the sperm**.

**(iii) Neck :** It is very short and constrains two centrioles. These play an important role during the first cleavage of the zygote.

**(iv) Tail :** It is very long, slender and tapering. It is formed of cytoplasm. It's main function is to provide mobility to the sperm. End piece consists of the exposed axial sheath, which forms a fine filament.



**Fig : Mammalian sperm**

### 12.2 FEMALE REPRODUCTIVE SYSTEM :

Female reproductive system comprises of following parts :

- (i) Ovaries (ii) Fallopian tube (B) Uterus  
(iv) Vagina (v) Glands

**(i) Ovaries :** These are oval shaped lying near the kidney.

- Ovary is covered by two layers outer is made up of **germinal epithelial cells**.

- Inner layer is called as **tunica albuginea** which is made up of **fibrous connective tissues**.
- The ovary consists of inner part called as **stroma**.
- It's outer peripheral part is called as **cortex** while inner part is called a **medulla**.
- **Medulla** consists of connective tissues containing numerous blood vessels, lymphatic vessels and nerves.
- **Cortex** consists of graffian follicles in all the stages of development.

The developing oocyte is called as primary oocyte

↓  
This primary follicle undergoes maturation to form secondary follicle or secondary oocyte

↓  
It later on forms follicular layer

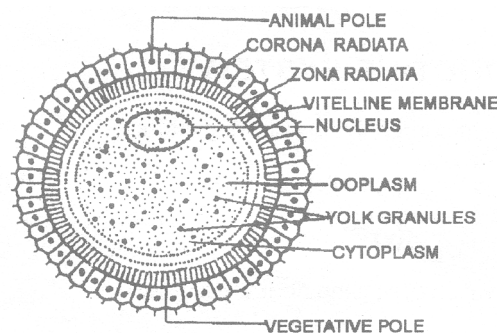
↓  
This follicular layer undergoes mitotic division to form secondary egg membrane.

↓  
This stage is called as secondary follicle

↓  
This is called as graffian follicle

#### FLOW CHART SHOWING THE FORMATION OF GRAFFIAN FOLLICLE

- Cortex also consists of large mass of yellow cells termed as **corpus luteum**, formed in an empty graffian follicle after the release of it's ovum.
- The cells of corpus luteum secrete the hormones  
(A) progesterone during pregnancy. (B) Relaxing at the end of pregnancy.
- Oestrogen is secreted by graffian follicle and intestinal cells. It's secretion is maximum during ovulation. It is also secreted during pregnancy.



**Fig : structure of ovum .**

(ii) **Fallopian tube** : It is about 10 cm. long muscular tube. It shows 4 regions :

- (A) **Infundibulum** : It is the broad, funnel shaped proximal part of fallopian tube. It's margin bears finger like processes called as **fimbriae**. This is meant to carry ovum by ciliary movement to the uterus.
- (B) **Ampulla** : It is a long, wide part of the fallopian tube next to the Infundibulum.
- (C) **Isthmus** : it is the narrow part that follows ampulla.
- (D) **Uterine part** : It is also narrow and passes through the uterine wall.

(iii) **Uterus** : It is large, highly elastic sac specialized for the development of the embryo.

- It is situated in a **pelvic cavity**.

- It is attached to the fallopian tube from the sides and below it opens into vagina through **cervix**.

- This uterus undergoes cyclic changes during phases of menstrual cycle.

(iv) **Cervix** : Lower narrow cervix that projects into the vagina. The cervix communicates above with the body of the uterus and below with the vagina.

(v) **Vagina** : It is a large, median, elastic, muscular tube. This canal opens externally into **labia minora** and **labia majora**. It's folds consist of stratified squamous epithelium which has mucous lining. It secretes a lubricant fluid. **Labia majora** is the innermost, thin, moist fold. **Labia minora** is outer large and hair covered. pH of vagina is 4.3. It is also called a "**Birth canal**".

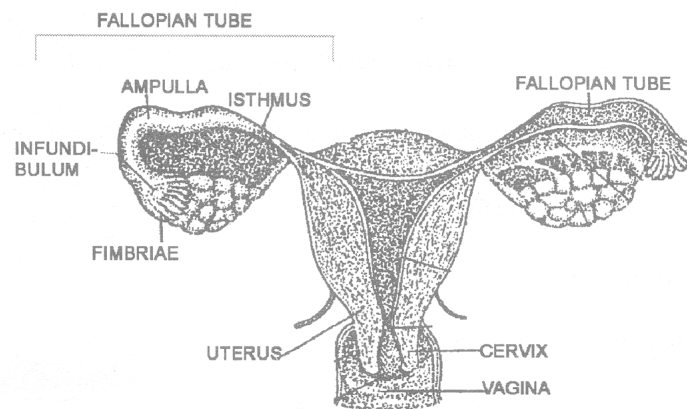


Fig : Female reproductive system.

(vi) **Gland** :

- **Bartholin's gland** : it secretes a clear, viscous fluid under sexual excitement.

- The fluid serves as a lubricant during copulation or mating.

## 12.2 (a) menstrual Cycle :

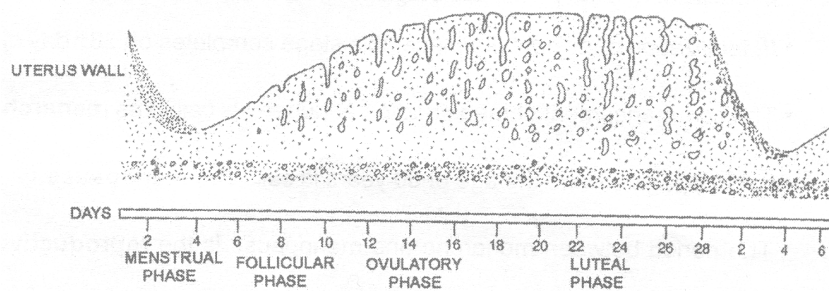


FIG : SHOWING VARIOUS PHASES OF MENSTRUAL CYCLE

- It is a cyclic phase of the flow of blood with mucus and tissues etc. from the uterus of a woman at monthly interval.

- It occurs on average of 28 days interval.

- It starts at the age of 12-14 years and stops at 45-50 years of life.

- This cycle stops during pregnancy.

- The menstrual cycle consists of following phases :

(i) **Bleeding or menstrual phase** :

- It is the first stage of menstrual cycle.



- It's duration is of 5 days but normally bleeding is found for 2-3 days.
- In this stage hormones **estrogen, progesterone, follicle stimulating hormone** and **luteinizing hormone** are found in minimum quantity.
- Total 100 ml, of blood flows in a complete bleeding phase.

**(ii) Proliferative phase :**

- In this phase F.S.H. stimulate development and maturation of graffian follicles.
- In this phase oestrogen level rises which leads to formation of new endometrium.
- It lasts for about 10 - 14 days. Thinnest endometrium is found in this phase.
- It is also called as **follicular phase**.

**(iii) Ovulation phase :**

- At this phase ovulation occurs.
- Ovulation occurs in the presence of FSH and LH.
- Thicket endometrium found in this stage.
- It also lasts for about 14 days.

**(iv) Secretory phase :** In this sage both oestrogen and progesterone levels are high.

- If fertilization takes place, this stage extends till to the parturition (giving birth to a child)
- If, fertilization does not take place, this stage completes on 28<sup>th</sup> day of menstrual cycle.
- The commencement of menstruation of puberty is called as **menarche**.
- It's stoppage around the age of 50 years is called as **menopause**.
- The period between menarche and menopause is the **reproductive phase** in human female.

## **12.2 (b) Oogenesis :**

Oogenesis is a process of formation of ovum. the ovum is a rounded, non-motile cell. It's size varies in different animals depending upon the amount of yolk in it.

**Ovum consists of two types of coverings :**

(i) Inner thin, transparent, non-cellular, covering called as **zona pellucida**. it is composed of protein and sugars. It is secreted y by follicle cells.

(ii) Outer thick covering is called as **corona radiata**.

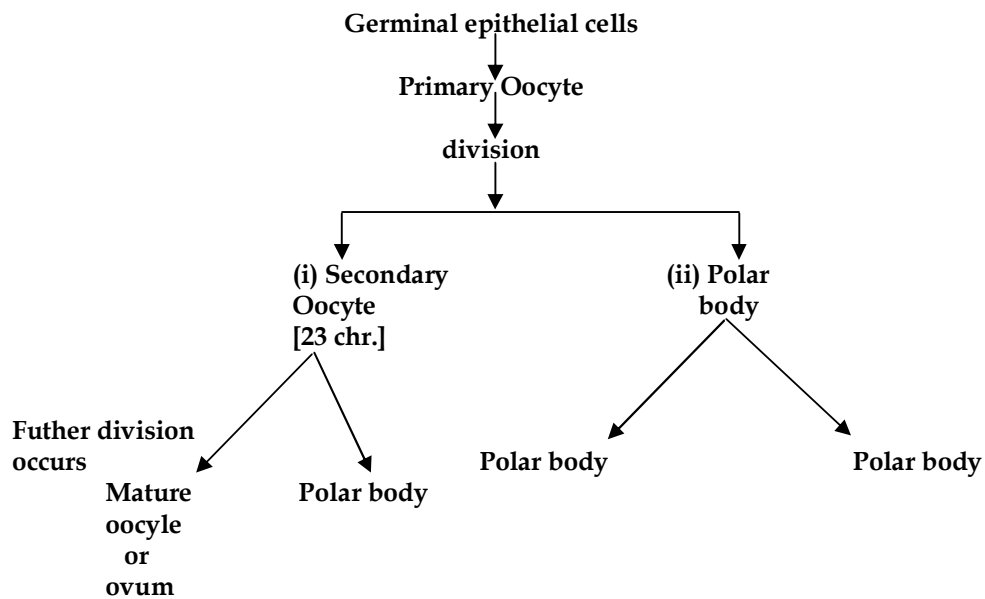


FIG : THE PROCESS OF OOGENESIS

### 12.3 FERTILIZATION :

- It included release of ovum from the ovary, where it remains viable for 12 - 24 hours.
- At the time of sexual intercourse the sperm enters in to the vagina.
- Only one sperm is required for fertilization of the ovum.
- The head of the sperm penetrates the corona radiate layer of ovum and then the **zona pellucida** layer.
- This process is facilitated by acrosome and proteolytic enzymes.
- After penetration the tail and body of the sperm is lost, only head remains inside the ovum.
- It's head begins to swell and forms **male pronucleus**.
- Here the pronuclei of sperm and ovum fuse to form a new resultant nucleus each contributing 23 chromosome, so that the resultant may have 46 chromosomes.

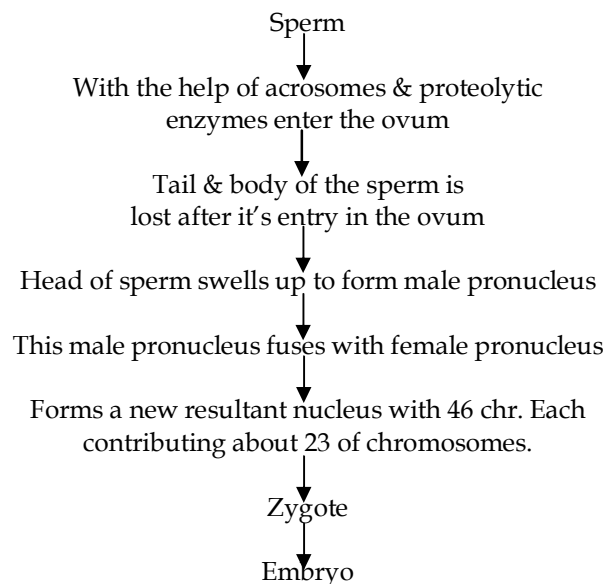


Fig : Showing process of fertilization

- Fusion of male & female gametes is called as **fertilization**. Zygote starts developing in fallopian tube and forms embryo, this later on moves to uterus. It gets attached to uterine walls and the whole process is called as **implantation**
- Placental formation occurs between uterine wall and the foetus, which provides nourishment to the foetus.
- The time period for which a developing fetus remains inside the mother's womb is called as **gestation period**. it extends for about 9 months or 40 weeks or 280 days.
- The process of giving birth to baby is called as **parturition**.

#### 12.4 ARTIFICIAL INSEMINATION :

- It is a technique to make a female pregnant by artificially introduction semen into vagina.
- In this process semen from a good quality male is collected, preserved by freezing and used when required.
- In case of humans it is also being used for improving the chances of fertility.
- A man may be infertile due to insufficient number of sperms, weak or premature ejaculation, inability of penis to undergo and enter the vagina or nonmotile sperms.
- In this case husband's semen is collected, concentrated and introduced artificially into the wife's vagina. this is called as **artificial insemination**.
- If the husband's sperms are faulty, some donors sperm can be used. This is called as **artificial insemination donor**.
- **Artificial insemination has following two advantages.**
  - (i) Semen of good quality male animal is used to inseminate a number of females.
  - (ii) Preserved semen can be transported to distant places, excluding the need for sending the male animal there.

Differences between asexual and sexual reproduction	
Asexual reproduction	Sexual reproduction
1. It is always uniparental	It is generally biparental.
2. Gametes are not formed.	Gametes are formed
3. There is no fertilization.	Fertilization occurs in it.
4. It involves mitotic cell division.	It involves meiotic cell division.
5. Daughter individual are genetically identical to the parent	Daughter individual are different from the parents.
6. It does not contribute to the evolution.	It contributes to the evolution by introduction of variation in the offspring

#### 12.5 POPULATION GROWTH :

- The term population refers to the total number of individuals of a species occupying particular geographical area at a given time.

- The scientific study of human population is called as “**demography**”.
- **Factors that lead to increase in population are :**
  - (i) Increase in protection from risk
  - (ii) Illiteracy
  - (iii) Desire of son
  - (iv) Decline in death rate
  - (v) Desire for more earning hands
  - (vi) Unawareness of various birth control measures

## 12.6 METHODS ADOPTED FOR POPULATION CONTROL

### (i) **Planned control of population :**

- (A) By educating people about the advantages of small family.
- (B) Raising the age of marriage can help in reducing population growth.
- (C) By family planning.

### (ii) **Temporary methods :**

(A) **Safe period :** A week before and after the menstrual cycle is considered to be infertile and fertilization, does not occur during this period.

(B) **Coitus interrupts :** It involves withdrawal by males before ejaculation so that semen is not deposited, in vagina.

(C) **Chemical means :** These includes certain jellies, paste, foam tables which when introduced into vagina cause immobilization of sperms and kill them. They also include contraceptive pills which inhibit secretion of F.S.H. and L.H. ovulation is inhibited.

### (D) **Mechanical means :**

- They involve use of condoms.
- Use of cervical or diaphragm cap which is fitted in the vagina that checks the entry of sperms.
- **IUD (intrauterine device)** called as **copper-T** is also fitted in the uterus which prevents fertilization.

(E) **Surgical methods:** It involves **tubectomy** in females which involves cutting of fallopian tube, and **vasectomy** in males which involves cutting of vas deference from both the sides. However, surgical removal of ovaries also occurs which is called as **ovariectomy** and in males removal of testis called as **castration**.

- **Abortion :** Medical termination of pregnancy is called as **abortion**.

## OBJECTIVE QUESTIONS

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1. In mammals, the testes lies in scrotal sacs due to  
(A) presence of urinary bladder (B) presence of rectum  
(C) long vas-deference (D) requirement of low temperate for spermatogenesis
2. Graffian follicles are found in  
(A) testis of mammas (B) ovary of frog (C) ovary of cockroach (D) ovary of mammals
3. Site of fertilization in mammals is  
(A) ovary (B) uterus (C) vagina (D) fallopian tube
4. The process of reproduction which involves only a single parent to form an individual  
(A) sexual reproduction (B) asexual reproduction  
(C) none of these (D) Both A & B are correct
5. Cowper's glands are found in  
(A) male mammals (B) female mammals (C) male amphibians (D) female amphibians
6. Loss of reproductive capacity in women after age of 45 years is  
(A) menstruation (B) ageing (C) menopause (D) menarche
7. Release of oocytes from ovary is  
(A) gestation (B) ovulation (C) parturition (D) implantation
8. Acrosome is made up of  
(A) mitochondria (B) centrioles (C) golgi bodies (D) ribosomes
9. Acrosome aids the sperm to  
(A) penetrate vitelline membrane of ovum (B) find ovum  
(C) swim (D) higher activity
10. Progesterone is secreted by  
(A) corpus luteum (B) thyroid (C) thymus (D) testis

## SUBJECTIVE QUESTIONS

### SHORT ANSWER TYPE QUESTIONS

1. Why regeneration is considered to be a method of reproduction ?
2. When an organism is called as bisexual, what does it indicate ?
3. Define fertilization.
4. What happens to the ovule and the ovary after fertilization?
5. Define the term puberty.

### LONG ANSWER TYPE QUESTIONS

6. What is name the sexual cycle in human females called ? Explain the sexual cycle in human female.
7. What do you understand by gestation period and what is it's time duration ?
8. In case of self-pollination there are two possibilities. State them.
9. What is the function of fallopian tube ?
10. What is semen ?

## ANSWER

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	C	D	C	A	B	B	B	B	A	C

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	D	D	D	B	A	C	B	C	A	A