

**SECTION - A**

- Ans 1.**
- (i) CNG is cheaper than diesel.
  - (ii) Cannot be siphoned off by thieves & adulterated.
  - (iii) CNG burns most efficiently.

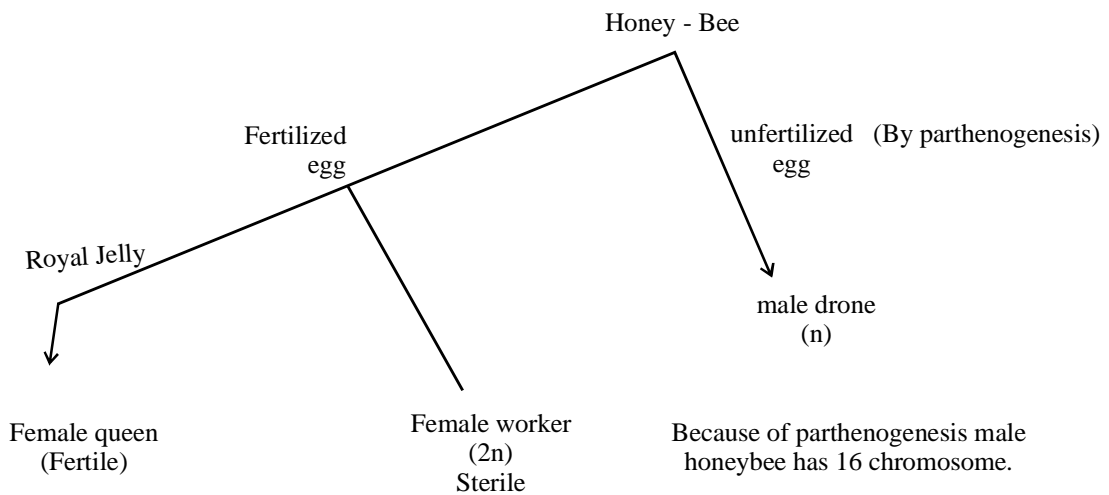
**Ans 2.** Animals that have had their DNA manipulated to possess and express an extra (foreign) gene are known as transgenic animals.  
**Eg.** – Transgenic rats / rabbits / pigs / Sheep / Cows.

**Ans 3.** Homo habilis did not eat meat- Homo erectus ate meat.

**Ans 4.** Multiple ovulation embryo transfer (MOET) technology is a programme for herd improvement.

- (i) The method includes following steps:
  - (a) A cow is administered with hormones FSH-like activity, to induce follicular maturation and superovulation.
  - (b) The cow produces 6-8 eggs instead of one egg, normally released per cycle.
  - (c) A cow is now mated with an elite bull or artificially inseminated.
  - (d) The fertilised eggs at 8-32 celled stages are recovered non-surgically and transferred to surrogate mothers.
  - (e) The genetic mother can again be used for superovulation.

**Ans 5.**



**SECTION -B**

- Ans 6.** Free living – Azospirillum / Azotobacter, Symbiotic – Rhizobium  
They are called bio-fertilizers because they enrich the nutrient quality of soil.
- Ans 7.** After getting into body of a person, the virus enters into macrophages where RNA genome of virus replicates to form viral DNA with the help of enzyme reverse transcriptase. The viral DNA gets incorporated into host cells DNA and directs the infected cell to produce virus particles. The macrophage continue to produce virus and in this way acts like a HIV factory. Simultaneously HIV enters into helper T-lymphocytes ( $T_H$ ), replicates and produce progeny viruses. The progeny viruses released in the blood attack other helper T-lymphocytes. This is repeated leading to a progressive decrease in the number of helper T-lymphocytes in the body of infected person. During this period the person suffers from bouts of fever, diarrhoea and weight loss.
- Ans 8.** Balance between production and degradation of ozone in the stratosphere has been disrupted due to enhancement of ozone degradation by chlorofluoro carbon (CFCs). CFCs find wide use as refrigerants. CFCs discharged in the lower part of atmosphere move upward and reach stratosphere. In stratosphere, uv rays act on them reacting Cl atoms. Cl degrades ozone releasing molecular oxygen, with these atoms acting merely as catalysts. Cl atoms are not consumed in the reaction. Hence whatever CFC are added to stratosphere, they have permanent and continuing effects on ozone level
- $$\begin{aligned} \text{CFC}_3 &\xrightarrow{\text{uv-C}} \text{CFC}_2 + \text{Cl} \\ \text{CFC}_2 &\xrightarrow{\text{uv-C}} \text{CFC} + \text{Cl} \\ \text{Cl} + \text{O}_3 &\rightarrow \text{ClO} + \text{O}_2 \quad \text{ClO} + \text{O}_3 \rightarrow \text{Cl} + 2\text{O}_2 \end{aligned}$$
- Ans 9.** genetic code is the Relationship between the sequence of Nucleotides on m-RNA and the sequence of amino acids in the polypeptide.
- One codon codes for only one Amino acid hence. it is unambiguous and specific.
  - Some amino acids are coded by more than one codon, Hence the code is degenerate
  - The code is nearly universal. for example from bacteria to human UUU would code for phenylalanine some exception & to this Rule have been found in mitochondrial codon and in some protozoans.
  - Stop codon :- In genetic code. a stop codon or (termination codon) is a Nucleotide triplet with messenger RNA that signals a termination of translation.
- Ans 10.** Papaya is dioecious because the staminate and Pistillate flowers are born on two different plants. self fertilization is not found in papaya so flower may be developing at different time that's why few plants having fruits.

**SECTION - C**

- Ans 11.** (a) As traditional breeding techniques failed to keep pace with demand and to provide sufficient and efficient system for crop improvement.
- It is difficult to maintain purity of offspring produced by traditional breeding techniques

- (b) Advantages of micro propagation –
  - more number of plants can be produced in short time.
  - Disease free plant can be produced.
  - Seedless plants can be multiplied.
- (c) Examples – Banana, Sugar cane.

**Ans 12.** When a host is exposed to antigens, which may be in the form of living or dead microbes or other proteins, antibodies are produced in the host body. This type of immunity is called active immunity. Active immunity is slow and takes time to give its full effective response. Children who had suffered from chicken pox in their childhood, may not contract the same disease in their adulthood because they have developed antibody to chicken pox virus. Virus-infected cells secrete proteins called interferons, which protect non-infected cells from further viral infection.

**Ans 13.** The organs with same structural design and origin but different functions are called homologous organs. This is divergent evolution and these structures are homologous. Homology indicates common ancestry. Other examples are vertebrate hearts or brains. In plants also, the thorn and tendrils of Bougainvillea and cucurbita represent homology. Homology is based on divergent evolution whereas analogy refers to a situation exactly opposite. Wings of butterfly and of birds look alike.

**Ans 14.** Oral administration of small doses of either progesterone or progesterone-estrogen combination is a contraceptive method used by females. They are used in the form of tablets and hence are called pills. Pills have to be taken daily for a period of 21 days starting preferably within the first five days of menstrual cycle. After a gap of 7 days it has to be repeated in the same pattern till the female desires to prevent conception. They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent / retard entry of sperm. Saheli – the new oral contraceptive for females contains a non-steroid preparation. It is “once a week” pill with very few side effects and high contraceptive value.

**OR**

Parthenocarpy is development and production of seedless fruit in absence of fertilization. Where apomixis refers to development of seed & fruit without fertilization. So the main difference b/w apomixis and fertilization is that seeds are formed in former and absent in later.  
Methods of apomictic developments

- (i) **Recurrent agamospermy :-** Agamospermy is the formation of seed that has an embryo formed without meiosis and syngamy. It is of two types – (a) noncurrent and (b) recurrent. In noncurrent embryo is haploid. Therefore the seed having it is nonviable. In recurrent agamospermy all the cells of embryo sac are diploid as it is formed directly either from a nucellar cell (apospory)
- (ii) **Adventive embryony (Sporophytic budding) –** An embryo develops from diploid cell other than egg like that of nucellus and integument. It gives rise to a condition called polyembryony or the phenomenon of having more than one embryo. There may be more than one egg cell in an embryo sac or more than one embryo sac in an ovule. All the egg cells may get fertilized. Synergids and antipodal cells may also form embryos. In gymnosperms polyembryony can also occur due to cleavage of growing embryo. It is called Cleavage polyembryony.

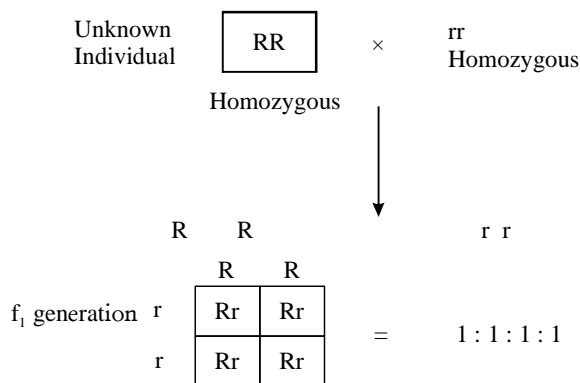
- Ans 15.** (a) YAC (Yeast artificial chromosome) & BAC (Bacterial artificial chromosome) are the vectors which are used in Human Genome project.
- In this Total Human DNA converted into random fragment of small size.
  - This small size fragment incorporate into vector & this vector are transferred or clone into suitable host cell.
  - ∴ YAC into Yeast  
BAC into Bacteria
  - This cloning resulted into amplification of each piece of DNA fragment this make sequencing with ease.
- (b) Less than 2% of the genome codes for proteins. 21.4% is discovered genes whose functions are known as observed during HGP  $\therefore \frac{30,000}{1,40,000} \times 100 = 21.4\%$
- (c) Single Nucleotide polymorphism.

- Ans 16.** ADA is caused due to deletion of the gene for adenosine deaminase. In some children it is caused by -
- 1) Bone marrow Transplantation
  - 2) Enzyme replacement therapy
- In enzyme replacement therapy functional ADA is given to the patient by injection
- 1) Lymphocyte from the blood of the patient are given in a culture outside the body
  - 2) A functional ADA cDNA ( using a retroviral vector ) is introduced into the lymphocyte , which are Returned to the patient.
  - 3) These cells are not immortal , the patient require them periodic infusion.
  - 4) If the gene isolate from marrow cells producing ADA is introduced into the cells at early embryonic stage, it could be permanent cure.

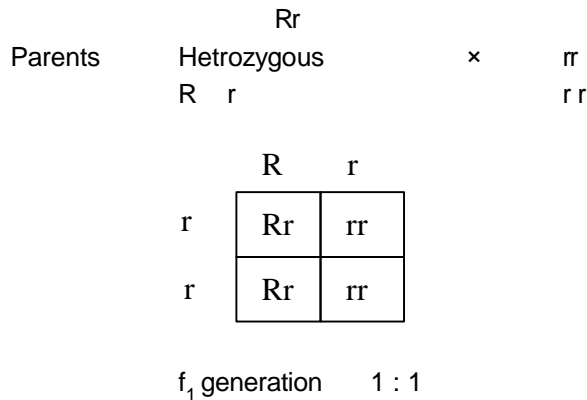
**TWO DISADVANTAGES OF THIS PROCEDURE**

- These cells do not always remain alive.
- Patient required periodic infusion of genetically engineered lymphocyte

- Ans 17.** Test cross is a cross between an organism with unknown genotype and recessive parent It is used to determine whether the Individual is homozygous or heterozygous for a trait If the progeny produced by a test cross show 50% dominant trait and 50% recessive trait then unknown individual is heterozygous for a trait on other hand if the progeny produced shows dominant trait then the unknown individual is homozygous for trait.



Unknow Individual



- Ans 18.** Oragnic pest controlled by modern method is -  
 Making pest resistant and protect against nematodes.  
**Ex** - a nematode meloidogyre incognitia infects the roots of tobacco plant and causes reduction in yield.  
 RNA interference ( RNA i ) involve silencing of a specific RNA .  
 Using agrobacterium vectors , Nematode specific gene are introduced into host plant.  
 The introduction of DNA was such that it produced both sense and antisense RNA into the host cells.  
 These two RNAs being complementary to each other formed a double stranded RNA that initiated RNA i
- b) In conventional pest control method, natural predators and parasites.  
**EX:-** Bacillus thuringensis are used to eliminate pest with minimal harm to the ecological balance of the environment.  
 The use of agrochemicals ( fertilizers & pesticides ) improve varieties of crops.
- Ans 19.** Selectable markers in the coming vectors pBR322 :
- Ampicillin resistance antibiotics
  - Tetracycline
- These help to recognise the transformation of desirable gene/ DNA introduced in host bacterium.
- b) B-galactosidase is preferred over selectable marker because due to inactivation of antibiotics, selection of recombinant become some process because it requires simultaneous plating having different antibiotics. Thus those enzymatic markers are used to differentiate recombinants and non-recombinants on the basis of their ability to produce colour in the presence of a chromogenic substance. If the plasmid in the bacterium does not have an insert, the presence of a chromogenic substrate give blue coloured colony.

**Ans 20.**

Primary Succession	Secondary succession
It occurs in an area which has been bare from the beginning	Secondary succession occurs in an area which has been denuded recently
Soil is absent at the time of beginning of primary succession	Soil is present in an area where secondary succession begins
There is no humus in the beginning	Humus is present from the very beginning
Reproductive structure of any previous community are absent.	Reproductive structures of the previous occupants are present in the area
Pioneer community comes from outside	Pioneer community develops partly from previous occupants and partly from migrants
Seral communities are many	Seral communities are few
Primary succession takes a long time for completion , 1000 years or more	Secondary succession takes less time for completion , 50-200 years.
In the beginning environment is very hostile	The environment is favourable from the beginning.

- Ans 21.**
- (A) It is necessary to make cell competent because competency enhance the efficiency of cell to take up foreign DNA easily.  
Cell treated with calcium solution it makes pores on cell which facilitate foreign DNA to enter in to cell.
- (B) Biolistics & Gene gun is one of the foreign DNA transfer method.  
In this micro-particles of gold & tungsten coated with DNA bombarded with high velocity to suitable plant cell.  
Biolistics help in Biotechnology to make Genetically modified plant.

- Ans 22.** Some species interact so intimately that they can cause evolutionary changes in each other over time. this is called co.evolution.  
coevolution is common among. organism participating in a mutual interaction. in mutualism. both the organism benefit from each other. when coevolution occurs. among mutually benefiting species. it is called mutualistic coevolution. when coevolution is found among species that have negative effects on each other. it is called competitive coevolution. there are two kinds of interactions. between species that can lead to competitive coevolution predation is when one organism kills and eats another organism. the prey is the species that gets eaten. by the predator. which is of course the species that eats the prey.
- Parasitism is when one organism benefits by damaging but not killing. another organism the parasite species benefits from this relationship. while the host the host species is negatively affected.
  - Parasitism :- is the mode of interaction between two species in which one species (Parasite)

depends on the other species (host) for food and shelter and in this process damages the host. In this process, one organism, is benefitted (Parasite). while the other is being harmed. (host)

**Example–** (i) Human liver fluke ( a trematode parasite) depends on two intermediate hosts (a snail and a fish) to complete its life cycle.

(ii) malarial parasite (plasmodium) needs a vector (mosquito) to spread disease to other hosts.

#### SECTION - D

- Ans 23.**
- (a) In India the female partner is often blamed for couple being childless-because –
- our society is male dominating society so nobody blames male. only females are blamed for being childless.
  - Lack of education, awareness is the another reason. People are not aware about scientific reason of infertility.
- (b) Reasons responsible for infertility could be –
- |              |                 |                 |
|--------------|-----------------|-----------------|
| – congenital | – Physical      | – diseases      |
| – drugs      | – Immunological | – Psychological |
- (c) Artificial insemination is a technique that can help the couple to have a child where the problem is with male partner.  
In this technique, semen collected either from husband or a healthy donor is artificially introduced into vagina or uterus.

#### SECTION - E

- Ans 24.**
- (a) Polygenic inheritance is an inheritance pattern controlled by three or more genes (multiple genes) and the graded phenotypes are due to the additive or cumulative effect of all the different genes of the trait.  
Example of human skin colour to understand the phenomenon of polygenic inheritance.  
Skin colour in humans is caused by a pigment called melanin. The quantity of melanin is due to three pairs of polygenes (A, B and C). If it is black or very dark (AA BB CC) and white or very light (aa bb cc) individuals marry each other the offspring or individuals of  $F_1$ -generation show intermediate colour often called mulatto (Aa Bb Cc).  
A total of eight allele combinations is possible in the gametes forming 27 distinct genotypes distributed into 7 phenotypes, i.e. 1 very dark, 6 dark, 15 fairly dark, 20 intermediate, 15 fairly light and 1 very light.
- (b) Mendelian inheritance can be explained by monohybrid cross and dihybrid cross. monohybrid cross. is responsible for one character of an individual inherited by the offspring from the parent. dihybrid cross is responsible for two character of an organism inherited simultaneously without change in their form.  
If multiple genes control single trait of one individual. They are said to be polygenic genes and the Trait is called as polygenic trait. Polygenic inheritance is the inheritance of traits controlled by multiple genes.

Pleiotropy is the phenomenon in which one gene affects more than one phenotype of an individual.

**E.g.** the gene responsible for the skin coat colour of an individual also affects its viability.

**OR**

- (a) Stage in the cell cycle where DNA replication occurs is S-phase.
- (b) DNA replication machinery and enzymes process of replication requires a set of catalysts (enzymes).
- (i) The main enzyme is DNA-dependent DNA polymerase, since it uses a DNA template to catalyse the polymerisation of deoxynucleotides. The average rate of polymerisation by these enzymes is approximately 2000 bp/second.
  - (ii) These polymerases have to catalyse the reaction with high degree of accuracy because any mistake during replication would result into mutations.
  - (iii) DNA polymerisation is an energy demanding process, so deoxyribonucleoside triphosphates serve dual purposes, i.e. act as substrates and provide energy for polymerisation reaction.
  - (iv) Many additional enzymes are also required in addition to DNA-dependent DNA polymerase.
  - (v) (a) Replication in DNA strand occurs within a small opening of the DNA helix, known as replication fork.  
(b) DNA-dependent DNA polymerases catalyse polymerisation only in one direction, i.e.  $5' \rightarrow 3'$ . It creates additional complications at the replicating fork. Consequently, on one strand (template  $3' \rightarrow 5'$ ), the replication is continuous, while on the other strand (template  $5' \rightarrow 3'$ ), it is discontinuous. The discontinuously synthesised fragments called Okazaki fragments are later joined by DNA ligase.
- (c) Watson and Crick proposed that DNA replication is semiconservative later in the year 1958, Meselson and Stahl proved this. The semiconservative nature of DNA suggests that, after the completion of replication, each DNA molecule will have one parental and one newly-synthesised strand.

**Ans 25.**

- (a) Growth models :-
- (1) Exponential growth
  - (2) Logistic growth
- (1) Exponential growth :-** Resource availability is essential for growth population. Any species growing exponentially under unlimited resource conditions can reach enormous population densities in a short time.
- (2) Logistic growth :-** In nature, a given habitat has enough resources to support maximum possible number, beyond which no further growth is possible.
- (b) The difference in shape of these curves depending on various factors including food availability, predation pressure and adverse weather. population in a given habitat during a given period,



fluctuates due to changes in four basic processes, two of which (natality & immigration) contribute to an increase in population density and two (mortality and emigration) to a decrease.

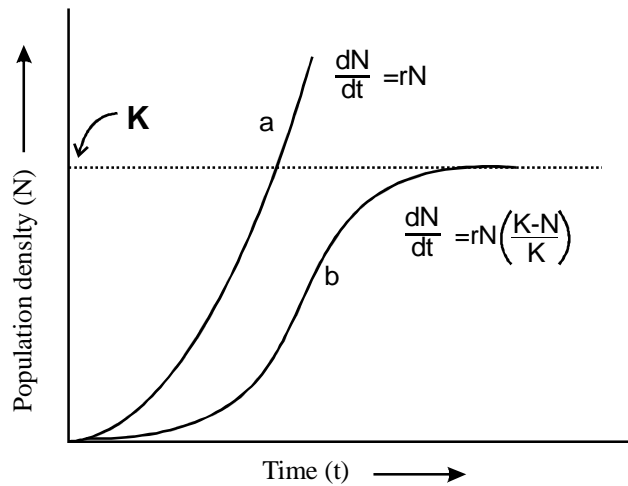
Natality – Number of birth during a given period.

Mortality – Number of death in the population

Immigration – Number of individuals of same speises that have come into habital

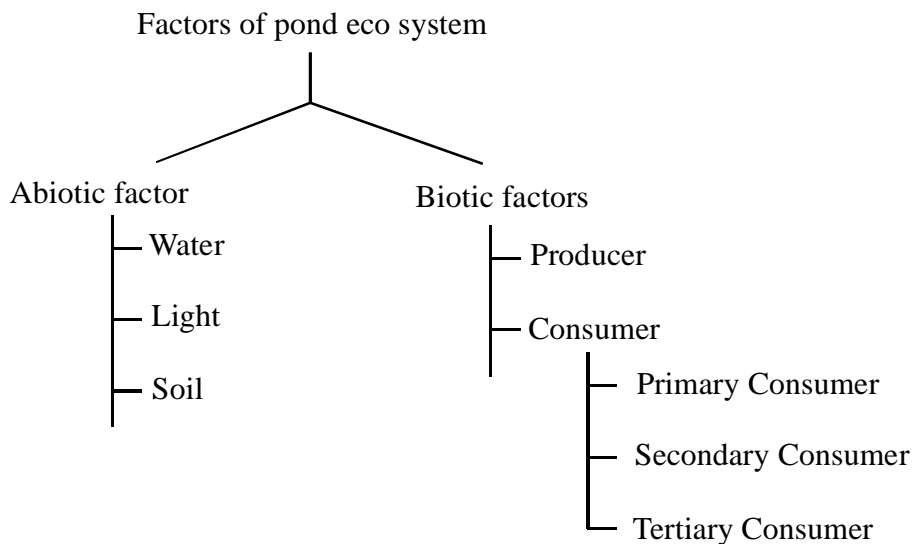
Emigration – Number of individuals who left the habibat.

- (c) Yes the population growth of today is sustainable as the population is maintaing according to the K (carrying capacity of land) where the law of survial for the fittest follow.



OR

- (a)



**Abiotic factor –**

- (1) Water = It includes pH of water, temp. of cuater, the gases and chemicals dissolved in it and seasonal changes in all of them including the water level.

- (2) Light = It is useful for plants for photosynthesis. It includes light intensity and Seasonal variations.
- (3) Soil = It is required for aquatic plants to take roots.

**Biotic factor –**

- (1) Producer :- They produce energy for pond food chain.  
Eg. phytoplankton
- (2) Consumer :- They consume energy or food produced by producers.
- (i) Primary consumer :- Dependant on phytoplankton for food & energy.  
Eg. – zooplankton.
- (ii) Secondary consumer :- Dependant on primary consumers for food.  
Eg. – Small fishes
- (iii) Tertiary consumer :- Dependant on secondary consumer for food & energy.  
Eg. – Large fishes.

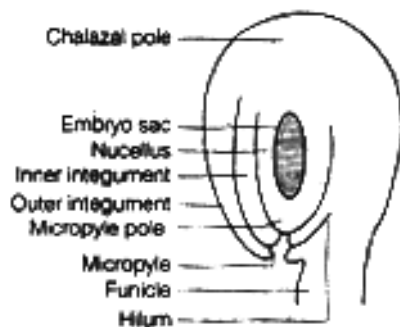
Producer → Primary consumer → Secondary consumer → Tertiary consumer  
(Phytoplankton) (zooplankton) (Small fishes) (Large fishes)

**Ans 26.**

- (a) The procedure to ensure cross-pollination in hermaphrodite flower
- (i) Emasculation :- If the female parent bears bisexual flower, removal of Anther from the flower bud before the anther dehisces
- (ii) Bagging :- Emasculated flowers have to be covered with, bag of suitable size generally made up butter paper to prevent contamination of Its stigma with unwanted pollen, this procedure is called Bagging.

When stigma of bagged flower attains receptivity, mature pollen grains collected from anthers of male parent are dusted to stigma and flowers are rebagged and fruits allowed to develop.

(b)



**OR**

- (a) Menstrual cycle is a rhythmic change in the reproductive organs of the females primates (monkey, apes and humans).
- (i) The first menstruation begins at puberty and is called menarche.
- (ii) Average interval of menstruation in human female is about 28-29 days.
- (iii) The cyclic events starting from one menstruation till the next one constitute menstrual cycle.

(iv) The four phases of menstrual cycle are:

Menstrual Phase

- (a) Cycle starts with this phase and the menstrual flow occurs for 3-5 days.
- (b) It occurs due to breakdown of endometrial lining of a uterus. The blood vessels form liquid which along with unfertilised ovum comes out through the vagina.
- (c) Menstruation occurs only if fertilisation does not take place.
- (d) Lack of menstruation generally indicates pregnancy but may also be due to stress, poor health, diseases, etc.

Menstrual phase is initiated by reduced secretion of LH (pituitary hormone) and progesterone and oestrogen (ovarian hormone). The endometrium breaks down and blood along with unfertilised ovum constitute menstrual flow.

Follicular phase in the menstrual cycle also referred as proliferative phase because Oestrogens stimulate the proliferation of the endometrium of the uterine wall. The endometrium becomes thicker by rapid cell multiplication and this is accompanied by an increase of uterine glands and blood vessels.

Both LH and FSH attain a peak level in the middle of cycle (about 14<sup>th</sup> day). Rapid secretion of LH leading to its maximum level during the mid-cycle called LH surge induces rupture of Graafian follicle and thereby the release of ovum (ovulation). The ovulation (ovulatory phase) is followed by the luteal phase during which the remaining parts of the Graafian follicle transform as the corpus luteum. The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy.

