LIBERTY PAPER SET

STD. 12 : Biology

Full Solution

Time : 3 Hours **ASSIGNTMENT PAPER 13**

Part A

1. (C) **2.** (B) **3.** (B) **4.** (D) **5.** (C) **6.** (A) **7.** (B) **8.** (A) **9.** (A) **10.** (B) **11.** (C) **12.** (D) **13.** (D) **14.** (C)
15. (A) **16.** (A) **17.** (D) **18.** (D) **19.** (B) **20.** (D) **21.** (C) **22.** (C) **23.** (C) **24.** (B) **25.** (D) **26.** (D) **27.** (B)
28. (B) **29.** (B) **30.** (C) **31.** (A) **32.** (D) **33.** (D) **34.** (B) **35.** (C) **36.** (D) **37.** (D) **38.** (A) **39.** (D) **40.** (A)
41. (B) **42.** (D) **43.** (D) **44.** (B) **45.** (A) **46.** (B) **47.** (B) **48.** (B) **49.** (A) **50.** (D)

Part B

Section A

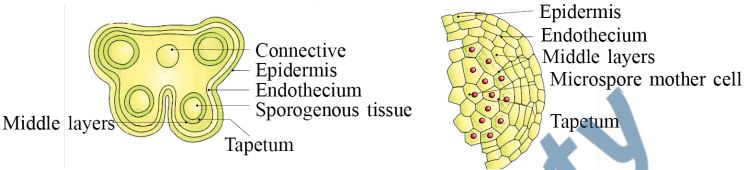
➢ **Write the answer of the following questions : (Each carries 2 Mark)**

1.

➥ In a transverse section, a typical microsporangium appears near circular in outline.

➥ It is generally surrounded by four wall layers – the epidermis, endothecium, middle layers and the tapetum.

- The outer three wall layers perform the function of protection and help in dehiscence of anther to release the pollen.
- The innermost wall layer is the tapetum. It nourishes the developing pollen grains.
- Cells of the tapetum possess dense cytoplasm and generally have more than one nucleus.
- When the anther is young, a group of compactly arranged homogenous cells called the sporogenous tissue occupy the centre of each microsporangium.

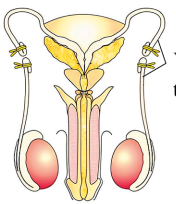


2.

(1) Vasectomy :

➥ Sterilisation procedure in the male is called 'vasectomy'.

➥ In vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum.



Vasectomy

3.

➥ Chromosomal disorder is caused due to absence or excess or abnormal arrangement of one or more chromosomes. It is of 2 types :

(i) Aneuploidy (ii) Euploidy

➥ (i) Aneuploidy

- Failure of segregation of chromatids during cell division cycle results in the gain or loss of a chromosomes, is called aneuploidy.

(i) Down's syndrome : It is the presence of an additional copy of chromosome number 21 (trisomy of 21).

- Total 47 Chromosome Present

➥ Features :

- They are short statured with small round head.
- Broad flat face.

- Furrowed big tongue and partially open mouth.
- Retarded physical, psychomotor & mental development.

(ii) Klinefelter's Syndrome : It is the presence of an additional copy of X-chromosome in male (trisomy).

- Features :
  - Overall masculine development. However, the fetninine developtnent is also expressed. e.g. Development of breast (Gynaecomastia).
  - Sterile.
  - Mentally retarded.

4.

mRNA		tRNA	
1.	In transcription, it helps in providing the template and therefore it is also known as messenger RNA	1.	In transcription, it acts as an adaptor that brings the amino acids and reads the genetic code therefore it is also known as transfer RNA.
2.	It has a linear shape.	2.	It has an inverted L shape and it looks like a cloverleaf.
3.	It shows attachment with ribosomes only.	3.	It shows attachment with both ribosomes and amino acids. From one end, it is attached with a ribosome and from another end, it is attached with aminoacids.

5.

- Ernst Haeckel gave the embryological basis of development.
- Based on his observation some traits are common in all lineages during the embryonic stage, but absent in the adult organism.
- For example, in the embryos of all vertebrates including humans, there is a row of vestigial folds behind the head, but it is only functional in fish, not in other adult vertebrates.
- However, the proposed embryological basis of this development was rejected in a careful study by Karl Ernst von Baer.
- He noted that embryos sometimes do not pass through the adult stages of other animals.

6.

Active Immunity	Passive Immunity
1) Fast, and provides immune response	1) Slow and takes time to become effective
2) Antibodies are produced in the host body	2) Ready-made antibodies are given to host
3) Provides immunological memory	3) Does not provide immunological memory
4) Long lasting	4) Short lived

7.

- Masses of bacteria associated with fungal filaments to form mesh like structures forms flocs.
- While growing, these microbes consume the major part of the organic matter in the effluent.

8.

- It is an example of Commensalism. (+, O)
- This is the interaction in which one species benefits and the other is neither harmed nor benefited.
- An orchid growing as an epiphyte on a mango branch but mango doesn't get any nourishment.
- In this interaction orchid gets abiotic factors easily.

9.

- Apple is a false fruit because it is not formed from ovary but major portion of it is formed from thalamus of flower.
- In case of apple thalamus forms the fruit.

10.

- (a) GIFT - gamete intra fallopian transfer :
- Transfer of an ovum collected from a donor into the fallopian tube (GIFT - gamete intra fallopian transfer) of another female who cannot produce one, but can provide suitable environment for fertilisation and further development is another attempted method.

(b) IUI - intra-uterine insemination :

- Infertility cases either due to inability of the male partner to inseminate the female or due to very low sperm counts in the ejaculates, could be corrected by artificial insemination (Al) technique.
- In this technique, the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI intra-uterine insemination) of the female.
- Though options are many, all these techniques require extremely high precision handling by specialised professionals and expensive instrumentation.
- Therefore, these facilities are presently available only in very few centres in the country.
- Obviously their benefits are affordable to only a limited number of people.
- Emotional, religious and social factors are also deterrents in the adoption of these methods.
- Since the ultimate aim of all these procedures is to have children, in India we have so many orphaned and destitute children, who would probably not survive till maturity, unless taken care of.
- Our laws permit legal adoption and it is as yet, one of the best methods for couples looking for parenthood.

11.

- In a broad ecological context, all carnivores, herbivores etc. are predators. About 25 % insects are phytophagous.
- If a predator overexploits its prey, then the prey might become extinct. It results in the extinction of predator. Therefore, predators in nature are 'prudent'.

Importance of predators :

- Predators control prey populations.
  - When certain exotic species are introduced into a geographical area, they spread fast due to the absence of its natural predators. E.g. Prickly pear cactus introduced into Australia (1920's) caused havoc by spreading. Later, it was controlled by introducing a cactus-feeding predator moth.
  - Predators are used in **Biological control** methods.
  - Predators **maintain species diversity** in a community by reducing competition among prey species.

    E.g. the predator starfish Pisaster in the rocky intertidal communities of American Pacific Coast. In an experiment, all these starfishes were removed from an enclosed intertidal area. It caused extinction of over 10 invertebrate species within a year, due to interspecific competition.
- **Defenses of prey species to lessen impact of predation :**
  - ***Camouflage*** (cryptic colouration) of some insects & frogs.
  - Some are **poisonous** and so avoided by the predators.
  - Monarch butterfly is highly distasteful to its predator bird. It is due to a special chemical in its body.
  - It is acquired during its caterpillar stage by feeding on a poisonous weed.
  - **Thorns** (Acacia, Cactus etc.) are the most common morphological means of defense of plants.

- Many plants produce chemicals that make the herbivore sick, inhibit feeding or digestion, disrupt its reproduction or kill it. E.g. *Calotropis* produce highly poisonous **cardiac glycosides.**
- Therefore cattle or goats do not eat it.
- **Nicotine, caffeine, quinine, strychnine, opium,** etc. are defenses against grazers and browsers.

12.

- Ecosystem term is introduced by A. G. Tansly for the first time.
- Ecosystem is a result of interaction between all living and non living factors of environment.
- In an Ecosystem, all biotic and abiotic components are linked by unidirectional energy flow and nutrients cycle.
- Biotic components : plants, animals, microbes.
- Abiotic components : solar energy, water, air and land etc.
- Types of ecosystem : Different types of ecosystems of nature, constitute the giant ecosystem-the biosphere. The ecosystems are categorised in to two as follows :
- (1) Natural ecosystems :
  - They are operated by themselves under natural conditions without any major interference by man.
- (2) Man-made ecosystems crop fields and aquarium
- Based upon the particular kind of habitat, these are further divided as :

  (i) Terrestrial ecosystems : (a) forest (b) grassland (c) desert.

  (ii) Aquatic ecosystems : They may be further divided as fresh water and marine water.

Section B

➢ **Write the answer of the following questions : (Each carries 3 Mark**

13.

- It include mons pubis, labia majora, labia minora, hymen, clitoris

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

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

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

  (d) Hymen : The opening of the vagina is often covered partially by a membrane called "hymen".

  (e) Clitoris : It is a tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening.
- The hymen is often torn during the first coitus (Intercourse). However, it can also be broken by a sudden fall or jolt, insertion of a vaginal tampon, active participation in some sports like horseback riding, cycling, etc.
- In some women the hymen persists even after coitus.
- In fact, the presence or absence of hymen is not a reliable indicator of virginity or sexual experience.

14.

- As polymorphism in DNA sequence is the basis of genetic mapping of human genome as well as of DNA fingerprinting, it is essential that we understand what DNA polymorphism means in simple terms.
- Polymorphism (variation at genetic level) arised due to mutations.
- New mutations may arise in an individual either in somatic cells or in the germ cells (cells that generate gametes in sexually reproducing organisms).
- If a germ cell mutation does not seriously impair individual's ability to have offspring who can transmit the mutation, it can spread to the other members of population (through sexual reproduction).
- Allelic sequence variation has traditionally been described as a DNA polymorphism if more than one variant (allele) at a locus occurs in human population with a frequency greater than 0.01.
- In simple terms, if an inheritable mutation is observed in a population at high frequency, it is referred to as DNA polymorphism.
- The probability of such variation to be observed in non-coding DNA sequence would be higher as mutations in these sequences may not have any immediate effect / impact in an individual's reproductive ability.
- These mutations keep on accumulating generation after generation, and form one of the basis of variability / polymorphism.
- There is a variety of different types of polymorphisms ranging from single nucleotide change to very large scale changes.

15.

- The rate of emergence of new forms of organisms and the life cycle OR are related to life span.
- The rate at which new forms of organisms appear and is related to the life cycle or life span.
- Rapidly dividing microorganisms have high multiplicity, reach millions within hours.
- A colony of bacteria growing in a given culture medium (say A) varies in terms of its ability to utilize food components.
- If the composition of the medium is changed, only that fraction of the population (say B) that survives the changed condition will remain.
- Over a certain period of time, a variant form of this population will outgrow the others and come into being as a new species.
- But when this matter is applied to fish or chicken, it takes millions of years because their life span is in years.
- It can be said that B's fitness is better than A's under the new conditions.
- So called fitness are based on characteristics or inherited.
- Therefore there must be a genetic basis for selection and development.
- In other words some organisms are better adapted to survive in a changing environment.
- Adaptability is hereditary. It has genetic basis.
- Fitness is the end result of the ability to adapt and to be selected by nature.
- Two key evolutionary concepts developed by Darwin are natural selection and branching.
- Darwin stated that variations that are inherited and are well adapted to a particular habitat and resource.

16.

- There is a time-lag (from few months to 5-10 years) between the infection and apperance of symptoms.
- During this period person suffers from fever, diarrhoea and weight loss.
- Due to deficiency of TH cells, he may be infected with mycobacterium, viruse, fungi & parasite like Taxoplasma.

17.

- We know that large quantities of waste water are generated everyday in cities and towns. A major component of this waste water is human excreta. This municipal waste water is also called sewage.
- It contains large amounts of organic matter and microbes, many of which are pathogenic.
- This cannot be discharged into natural water bodies like rivers and streams directly.
- Before disposal, hence, sewage is treated in Sewage Treatment Plant (STPs) to make it less polluting.
- The pollutants and pathogens in sewage cause water-borne animal disease like typhoid, cholera etc.

18.

- Several nematodes parasites a wide variety of plants and animals including human beings.
- A nematode *Meloidegyne incognitia* infects the roots of tobacco plants and causes a great reduction in yield.
- A novel strategy was adopted to prevent this infestation which was based on the process of RNA interference (RNAi).
- RNAi takes place in all eukaryotic organisms as a method of cellular defense.
- This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing).
- The source of this complementary RNA could be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate via an RNA intermediate.
- Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant.
- The introduction of DNA was such that it produced both sense and anti-sense RNA in the hostcells.
- These two RNA's being complementary to each other formed a double stranded (dsRNA) that initiated RNAi and thus, silenced the specific mRNA of then ematode.
- The consequence was that the parasite could not survive in a transgenic host expressing specific interfering RNA.
- The transgenic plant therefore got itself protected from the parasite.

19.

- This is the interaction in which one species benefits and the other is neither harmed nor benefited.
- An orchid growing as an epiphyte on a mango branch, and barnacles growing on the back of a whale benefit while neither the mango tree nor the whale derives any apparent benefit.

- The cattle egret and grazing cattle in close association, a sight you are most likely to catch if you live in farmed rural areas, is a classic example of commensalism.
- The egrets always forage close to where the cattle are grazing because the cattle, as they move, stir up and flush out insects from the vegetation that otherwise might be difficult for the egrets to find and catch.
- Another example of commensalism is the interaction between sea anemone that has stinging tentacles and the clown fish that lives among them. The fish gets protection from predators which stay away from the stinging tentacles. The anemone does not appear to derive any benefit by hosting the clown fish.

20.

- Animals that have had their DNA manipulated to possess and express an extra (foreign) gene are known as transgenic animals.
- Transgenic rats, rabbits, pigs, sheep, cows and fish have been produced, although over 95 per cent of all existing transgenic animals are mice.
- (i) Normal physiology and development :
  - Transgenic animals can be specifically designed to allow the study of how genes are regulated, and how they affect the normal functions of the body and its development,
  - e.g., study of complex factors involved in growth such as insulin-like growth factor. By introducing genes from other species that alter the formation of this factor and studying the biological effects that result, information is obtained about the biological role of the factor in the body.
- (ii) Study of disease :
  - Many transgenic animals are designed to increase our understanding of how genes contribute to the development of disease.
  - These are specially made to serve as models for human diseases so that investigation of new treatments for diseases is made possible.
  - Today transgenic models exist for many human diseases such as cancer, cystic fibrosis. rheumatoid arthritis and Alzheimer's.
- (iii) Biological products:
  - Medicines required to treat certain human diseases can contain biological products, but such products are often expensive to make.
  - Transgenic animals that produce useful biological products can be created by the introduction of the portion of DNA (or genes) which codes for a particular product.
- Examples :
  - human protein (α-1-antitrypsin) used to treat emphysema.
  - Similar attempts are being made for treatment of phenylketonuria (PKU) and cystic fibrosis.
  - In 1997, the first transgenic cow, Rosie, produced human protein-enriched milk (2.4 grams per litre). The milk contained the human α lactalbumin and was nutritionally a more balanced product for human babies than natural cow-milk.
- (iv) Vaccine safety :
  - Transgenic mice are being developed for use intesting the safety of vaccines before they are used on humans.
  - Transgenic mice are being used to test the safety of the polio vaccine.
  - If successful and found to be reliable, they could replace the use of monkeys to test the safety of batches of the vaccine.
- (v) Chemical safety testing :
  - This is known as toxicity/safety testing.
  - The procedure is the same as that used for testing toxicity of drugs.
  - Transgenic animals are made that carry genes which make them more sensitive to toxic substances than non-transgenic animals.
  - They are then exposed to the toxic substances and the effects studied.
  - Toxicity testing in such animals will allow us to obtain results in less time.

21.

- When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species.
- The Nile perch introduced into Lake Victoria in east Africa eventually led to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake.

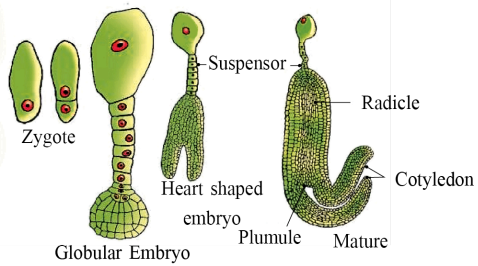
- The environmental damage caused and threat posed to our native species by invasive weed species like carrot grass (Parthenium), Lantana and water hyacinth (Eicchornia).
- The recent illegal introduction of the African catfish Clarias gariepinus for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.

Section C

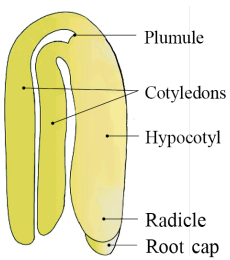
➢ **Write the answer of the following questions : (Each carries 4 Mark)**

22.

- Embryo develops at the micropylar end of the embryo sac where the zygote is situated.



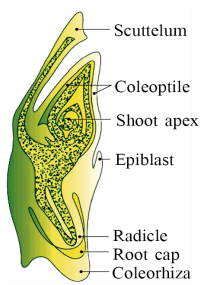
  - Most zygotes divide only after certain amount of endosperm is formed. This is an adaptation to provide assured nutrition to the developing embryo.
  - Though the seeds differ greatly, the early stages of embryo development (embryogeny) are similar in both monocotyledons and dicotyledons.
  - Figure depicts the stages of embryogeny in a dicotyledonous embryo. The zygote gives rise to the proembryo and subsequently to the globular, heart-shaped and mature embryo.
- Dicotyledonous embryo :
  - A typical dicotyledonous embryo, consists of an embryonal axis and two cotyledons.



(i) Epicotyl : The portion of embryonal axis above the level of cotyledons is the Epicotyl, which terminates with the plumule or stem tip.

(ii) Hypocotyl : The cylindrical portion below the level of cotyledons is Hypocotyl that terminates at its lower end in the radicle or root tip. The root tip is covered with a root cap.

- Monocotyledonous embryo :
  - Embryos of monocotyledons possess only one cotyledon.



(i) Scutellum : In the grass family the cotyledon is called scutellum that is situated towards one side (lateral) of the embryonal axis.

(ii) Coleorrhiza : At its lower end, the embryonal axis has the radical and root cap enclosed in an undifferentiated sheath called Coleorrhiza.

(iii) Coleoptile : The portion of the embryonal axis above the level of attachment of scutellum is the epicotyl. Epicotyl has a shoot apex and a few leaf primordia enclosed in a hollow foliar structure, the Coleoptile.

23.

➥ The testes are situated outside the abdominal cavity within a pouch called scrotum.

➥ The scrotum helps in maintaining the low temperature of the testes (2–2.5°C lower than the normal internal body temperature) necessary for spermatogenesis.

➥ In adults, each testis is oval in shape, with a length of about 4 to 5 cm and a width of about 2 to 3 cm.

➥ The testis is covered by a dense covering.

➥ Each testis has about 250 compartments called testicular lobules.

➥ **The Female External Genitalia :**

- It include mons pubis, labia majora, labia minora, hymen, clitoris.
  (a) **Mons Pubis :** It is a cushion of fatty tissue covered by skin and pubic hair.
  (b) **Labia majora :** These are fleshy folds of tissue, which extend down from the mons pubis and surround the vaginal opening.
  (c) **Labia minora :** These are paired folds of tissue under the labia majora.
  (d) **Hymen :** The opening of the vagina is often covered partially by a membrane called "hymen".
  (e) **Clitoris :** It is a tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening.
- The hymen is often torn during the first coitus (Intercourse). However, it can also be broken by a sudden fall or jolt, insertion of a vaginal tampon, active participation in some sports like horseback riding, cycling, etc.
- In some women the hymen persists even after coitus.
- In fact, the presence or absence of hymen is not a reliable indicator of virginity or sexual experience.

24.

➥ Mendel's studies mainly described those traits that have distinct alternate forms such as flower colour which are either purple or white.

➥ There are many traits which are not so distinct in their occurrence and are spread across a gradient.

Human Height :

➥ In humans we don't just have tall or short people as two distinct alternatives but a whole range of possible heights.

Human Skin Colour :

➥ Human skin colour is another classic example for this. In a polygenic trait the phenotype reflects the contribution of each allele, i.e., the effect of each allele is additive.

➥ Assume that 3 genes A, B, C control human skin colour. The dominant forms A, B & C responsible for dark skin colour and recessive forms a, b & c for light skin colour.

➥ Genotype with all the dominant alleles (AABBCC) gives darkest skin colour. Genotype with all the recessive alleles (aabbcc) gives lightest skin colour.

➥ Therefore, genotype with 3 dominant alleles and 3 recessive alleles gives an intermediate skin colour.

➥ Number of each type of alleles determines the darkness or lightness of the skin.

25.

➥ Prokaryotic Translation involves following step.

(i) Activation of amino acid

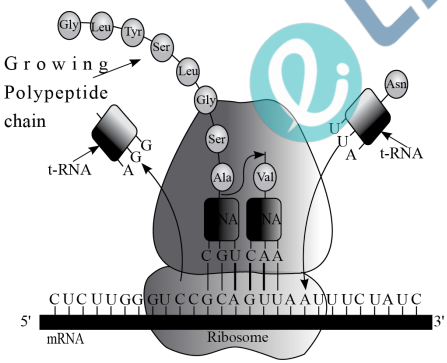
(ii) Formation of polypeptide chain

➥ Activation of amino acid

➥ In the presence of aminoacyl tRNA Synthatare (Enzyme), a specific amino acid reacts with ATP

➥ Amino acid + ATP + Enzyme $\xrightarrow{Mg^{2+}}$ Amino acid – amp - Enzyme (complex) + PPi

- In aminoacylation of tRNA, the a.acid - AMP - E (complex) reacts with uncharged t-RNA.
- Amino acid - AMP (complex) - Enzyme + t-RNA → Amino acid (Charged) - t-RNA + Enzyme + PPi
- Formation of Polypeptide chain
- The cellular factory responsible for synthesising proteins is the ribosome.
- The ribosome consists of structural RNAs and about 80 different proteins.
- In its inactive state, it exists as two subunits; a large subunit and a small subunit.
- When the small subunit encounters an mRNA, the process of translation of the mRNA to protein begins.
- There are two sites in the large subunit, for subsequent amino acids to bind to and thus, be close enough to each other for the formation of a peptide bond.
- The ribosome also acts as a catalyst (23S rRNA in bacteria is the enzyme - ribozyme) for the formation of peptide bond.
- A translational unit in mRNA is the sequence of RNA that is flanked by the start codon (AUG) and the stop codon and codes for a polypeptide.
- An mRNA also has some additional sequences that are not traslated and the referred as untranslated regions (UTR). The UTRs are present at both 5'-end (before start codon) and at 3' - end (after stop codon). They are required for efficient translation process
- Translation has 3 steps
- Initiation
- For initiation, the ribosome binds to the mRNA at the start codon (AUG) that is recognised only by the initiator tRNA.
- Elongation
- The ribosome proceeds to the elongation phase of protein synthesis. During this stage, complexes composed of an amino acid linked to tRNA, sequentially bind to the appropriate codon in mRNA by forming complementary base pairs with the tRNA anticodon.
- The ribosome moves from codon to codon along the mRNA.
- Amino acids are added one by one, translated into Polypeptide sequences dictated by DNA and represented by mRNA.
- Termination
- At the end, a release factor binds to the stop codon, termination translation and releasing the complete polypeptide from the ribosome.



26.

- These are the organs where origin/maturation & proliferation of lymphocytes occur. These are of two types : Primary & Secondary.
- (a) Primary lymphoid organs
  - The organs where lymphocytes are matured & differentiated to antigen-sensitive lymphocytes. It is of two types :
- 1) Bone marrow :
  - The site of formation of all blood cells including B & T-lymphocytes.
- 2) Thymus :
  - A bilobed organ seen near the heart and beneath the breastbone. It is large during birth but gradually reduces in size and becomes very small-sized in puberty. Immature T-lymphocytes from bone marrow is migrated to thymus and matured.

- (b) Secondary lymphoid organs
  - The organs, to which matured lymphocytes migrate from primary lymphoid organs, interact with antigens and then proliferate to become effector cells.
  - E.g. Spleen, lymph nodes, tonsils, Peyer's patches, Mucosa- associated lymphoid tissue (MALT) & appendix.
- Spleen :
  - Bean-shaped organ. Contains lymphocytes and phagocytes. It removes worn-out RBCs & microorganisms from blood. It is a reservoir of erythrocytes in foetus.
- Lymph nodes :
  - Found in lymphatic system. They trap microorganisms or other antigens. Trapped antigens activate lymphocytes and cause immune response.
- MALT :
  - Located within the lining of respiratory, digestive & urinogenital tracts. It constitutes 50% of lymphoid tissue.

27.

- Mostly plasmid and bacteriophage is used as a cloning vector.
- Plasmid and bacteriophage have the potential to replicate independently in the host cell without having control of chromosomal DNA.
- In each cell there are plenty of copies of bacteriophage which contains many copies of their genome.
- In certain bacteria, there are one or two copies of plasmid.
- Whereas others may have 15-100 copies per cell. Their numbers can go even higher.
- If we are able to link an alien piece of DNA with bacteriophage or plasmid DNA, we can multiply its numbers equal to the copy number of the plasmid or bacteriophage.
- Vectors used at present, are engineered in such a way that they help easy linking of foreign DNA and selection of recombinants from non-recombinants.