



**RJ VISION PVT. LTD.**  
(MOST STABLE & INNOVATIVE INSTITUTE)

**GSEB**  
**BPT – 1B**

**BIOLOGY**  
**TEST**

COURSE NAME: 12<sup>TH</sup>

Marks : 100 marks

Topic : FULL SYLLABUS

DATE : 27-12-2023

PART – A

**Instructions:**

- (1) There are 50 objective type (M.C.Q) questions in **part-A** and all questions are compulsory.
- (2) The questions are serially numbered from 1 to 50 and each carries 1 mark.
- (3) Read each question carefully, select proper alternative and answer in the O.M.R. sheet.
- (4) The OMR sheet is given for answering the questions. The answer of each question is represented by (A) O, (B) O, (c) O, (D)O. Darken the circle of the correct answer with ball-pen.
- (5) Rough work is to be done in the space provided for this purpose in the test booklet only.
- (6) Set No. of question paper printed on the upper-most right side of the Question paper is to be written in the column provided in the OMR sheet.

PART- A

1. What type of gametes will form by genotype RrYy  
 (1\*) RY, Ry, rY, ry  
 (3) Ry, Ry, Yy, ry  
 (2) RY, Ry, ry, ry  
 (4) Rr, RR, Yy, YY
2. In Mendelism, linkage was not observed due to  
 (1) Mutation  
 (3) Synapsis  
 (2\*) Independent assortment  
 (4) Crossing over
3. Which of the following is not a pyrimidine?  
 (1) Thymine  
 (2\*) Uracil  
 (3) Adenine  
 (4) Cytosine
4. A nitrogenous base is linked to the pentose sugar through:  
 (1) Phosphoester linkage  
 (3) Phosphodiester linkage  
 (2) O-Glycosidic linkage  
 (4\*) N-Glycocidic linkage
5. Correct representation of centrae dogma is as follows:  
 (1) DNA  $\xrightarrow{\text{Transcription}}$  mRNA  $\xrightarrow{\text{Transformation}}$  Protein  
 (2) DNA  $\xrightarrow{\text{Transcription}}$  mRNA  $\xrightarrow{\text{Translation}}$  Proteins  
 (3) Replication  $\xrightarrow{\text{DNA}}$  Transcription  $\xrightarrow{\text{mRNA}}$  Transformation  $\xrightarrow{\text{Proteins}}$   
 (4\*) Replication  $\xrightarrow{\text{DNA}}$  Transcription  $\xrightarrow{\text{mRNA}}$  Translation  $\xrightarrow{\text{Proteins}}$

6. A habitat of an organism constitutes \_\_\_\_\_.
- (1) Abiotic components (2) Biotic components  
(3) Symbiotic compounds (4\*) Both (1) and (2)
7. The temperature of habitat affects kinetics of \_\_\_\_\_ in the body of organisms.
- (1) Hormones (2\*) Enzymes  
(3) Inflammatory mediators (4) Neurotransmitters
8. Which of the following show maximum genetic diversity?
- (1\*) Rice (2) Mango  
(3) Rauwolfia vomitoria (4) Wheat
9. Species richness of tropics is because of:
- (1) Tropics have more evolutionary time (2) Tropics have relatively constant environment  
(3) Tropics receive more solar energy (4\*) All of the above
10. \_\_\_\_\_ is the alcoholic beverage obtained without distillation
- (1) Whiskey (2) Brandy (3\*) Wine (4) Rum
11. Vegetative cell in pollen grain:
- (1) Is bigger in size  
(2) Has abundant food reserves  
(3\*) Is spindle shaped with dense cytoplasm and nucleus  
(4) Floats in the cytoplasm of the generative cell
12. Variable part of DNA molecule is:
- (1) Phosphate (2) Sugar  
(3\*) Nitrogen base (4) All of the above
13. Ploidy of ovary, anther, egg, pollen, male gamete and zygote are respectively –
- (1)  $2n, 2n, n, 2n, n, 2n$  (2\*)  $2n, 2n, n, n, n, 2n$   
(3)  $2n, n, n, n, n, n$  (4)  $2n, 2n, n, 2n, 2n, 2n$
14. Aluminous / endospermic seeds are-
- (1\*) Coconut, castor, sunflower (2) Bean, pea  
(3) Groundnut, pea (4) None of above
15. In most plants; the fruit develops from the ovary, other parts degenerate and fall of such fruits are called-
- (1) False fruits (2\*) True fruits  
(3) Parthenocarpic fruit (4) None of the above
16. Emasculation is not required when flowers are-
- (1) Bisexual (2) Intersexual  
(3\*) Unisexual (4) Either (1) or (2)
17. Select true statement
- (1) Presence of hymen is a reliable indicator of virginity  
(2) Absence of hymen is a reliable indicator of sexual experience  
(3) Presence of hymen is a reliable indicator of sexual experience  
(4\*) Presence or Absence of hymen is not a reliable indicator of virginity
18. Both FSH & LH attain peak level at
- (1) Starting of Menstrual cycle (2) End of Menstrual cycle  
(3\*) Middle of cycle (4) All time during cycle

19. Corpus luteum produces  
 (1) Estradiol (2) Testosterone (3\*) Progesterone (4) None of these
20. Oral contraceptive pills are composed of-  
 (1) Progestogens only  
 (2) Progestogens – estrogens combinations  
 (3) Progestogens – testosterone combinations  
 (4\*) (1) or (2)
21. Negative charge of DNA is due to which of the following constituent  
 (1) Sugar (2) Nitrogenous base  
 (3\*) Phosphoric acid (4) Hydroxyl group (–OH) present on sugar
22. Okazaki fragments are synthesised on  
 (1) Leading strands of DNA only (2\*) Lagging strands of DNA only  
 (3) Both leading and lagging strands of DNA (4) Complementary DNA
23. Non infectious disease which is the major cause of death is –  
 (1) Arthritis (2\*) Cancer (3) Leprosy (4) Elephantiasis
24. Gametocytes develop in \_\_\_\_\_ malarial infection.  
 (1) Liver (2) WBC (3\*) RBC (4) Platelets
25. Public hygiene includes:  
 (1) Proper disposal of waste and excreta (2) Periodic cleaning and disinfection of water reservoir  
 (3) Regular cleaning of tanks for water storage (4\*) All of the above
26. AIDS, \_\_\_\_\_ are depleted from immune system.  
 (1\*) T – helper (2) T – Suppressor (3) T – Promoter (4) B – Cells
27. An organism used as a biofertilizer for raising soyabean crops is:  
 (1) Azotobacter (2) Azospirillum  
 (3\*) Rhizobium (4) Nostoc
28. Which one of the following is not a biofertilizer  
 (1\*) Agrobacterium (2) Rhizobium (3) Nostoc (4) Mycorrhiza
29. Read the following statement having two blanks (A and B):  
 A drug used for \_\_\_\_A\_\_\_\_ patients is obtained from a species of the organism \_\_\_\_B\_\_\_\_. The one correct option for the two blanks is:  
 (1) A: Heart, B: Penicillium (\*2) A: Organ-transplant, B: Trichoderma  
 (3) A: Swine flu, B: Monascus (4) A: AIDS, B: Pseudomonas
30. A nitrogen-fixing microbe associated with Azolla in rice field is:  
 (1) Spinulina (2\*) Anabaena (3) Frankia (4) Tolypothrix
31. Microbes are present in:  
 (1) Soil, water and air (2) Our bodies as parasites  
 (3) Geysers, deep in the soil (4\*) All of the above
32. Commensalism is a:  
 (1\*) +,0 interaction (2) +, + interaction (3) +, - interaction (4) -,0 interaction
33. The importance of ecosystem lies in:  
 (1) Flow of energy  
 (2) Cycling of nutrients  
 (3) Productivity  
 (4\*) All of the above

34. What indicates 'A' in below figure?



- (1\*) Pollen grains (2) Pollen sacs  
 (3) Generative cell (4) Vacuoles

35. Match the following:

Column – I	Column – II
(A) Vegetative cell	(1) Sporopollenin
(B) Generative cell	(2) Spindle-shaped cell
(C) Exine	(3) Large sized and has abundant food reserve
(D) Intine	(4) Cellulose and pectin

- (1) A:1, B:2, C:3, D:4 (2) A:4, B:3, C:2, D:1  
 (3\*) A:3, B:2, C:1, D:4 (4) A:2, B:1, C:4, D:3

36. Syncarpous condition is referred to as:

- (1) Gynoecium containing single pistil  
 (2\*) More than one pistil fused together  
 (3) More than one pistil free from one another  
 (4) Gynoecium containing many pistil

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

- (1) Seminal vesicle (2\*) Epididymis (3) Prostate (4) Bulbourethral

38. Of the following statements, which one is true for Mons Pubis

- (1) It is the region of pubic hair growth found in females as well as males  
 (2) It is a cushion of proteins covered by skin and pubic hair  
 (3\*) It is a cushion of fats covered by skin and pubic hair  
 (4) It is a part of female internal genitalia

39. LH surge causes:

- (1) Rupture of graafian follicle (2) Release of ovum  
 (3) Endometrial shedding (4\*) Both (1) and (2)

40. 'Pills' have to be taken for contraception continuously for a period \_\_\_\_\_ days.

- (1) 22 (2\*) 21 (3) 24 (4) 25

41. cryIIAB endotoxins obtained from Bacillus thuringiensis are effective against

- (1) Nematode (2\*) Bollworm  
 (3) Mosquito (4) Flies

42. Persistent nucleus in the seed is known as

- (1) Chalaza (2\*) Perisperm  
 (3) Hilum (4) Tegmen

43. Salt stress, disease resistance and cold stress in plants can be introduced by

- (1\*) Genetic engineering  
 (2) Tissue culture  
 (3) Hybridoma technology  
 (4) None of these

44. A very large number of amphibian species are endemic to:
- (1) Northeast
  - (2\*) Western Ghats
  - (3) Northwest Himalayas
  - (4) Andaman and Nicobar islands
45. Which of the following interactions is related to the mechanism of population control?
- (1) Completion
  - (2\*) predation
  - (3) Parasitism
  - (4) Neutral interaction
46. The levels of biological organization in ecology are –
- (1) Cell, Organism, Community, Biosphere
  - (2) Organisms, Family, Communities, Biomes
  - (3) Species, Populations, Communities, biomes
  - (4\*) Organisms, Populations, Communities, biomes
47. What is the formed in deficiency of ADA
- (1) Purine metabolism for T-lymphocytes functioning
  - (2) Monocytes
  - (3) Macrophages
  - (4\*) Both (2) and (3)
48. The organisms through natural selection have evolved \_\_\_\_\_ to optimize its survival and reproduction in its habitat.
- (1) Camouflage
  - (2\*) Adaptations
  - (3) Homoestasis
  - (4) Standing state
49. Earth was formed \_\_\_\_\_ billion years back
- (1\*) 4.5
  - (2) 5.5
  - (3) 3.5
  - (4) 1.5
50. Find the incorrect statement?
- (1) Constant environment promote niche specialization
  - (2) Key species are those which derive major ecosystem functions
  - (3) Increase in diversity generally increases productivity
  - (4\*) Increase steepness in species area relationship curve decreases species richness in a given area

### PART- B

#### Instructions:

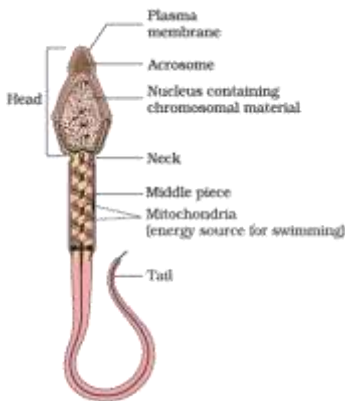
- (1) Write in a clear legible handwriting.
- (2) There are three sections in part- B of the question paper and total 1 to 27 questions are there.
- (3) All the questions are compulsory. Internal options are given.
- (4) The numbers at right side represent the marks of the question.
- (5) Start new section on new page.
- (6) Maintain sequence.

**SECTION – A [2 M]**

Answer question No. 1 to 12 as directed. Each question carry 2 marks. (Attempt any 8 out of 12)

[16]

1. Describe the structure of a sperm with diagram.



**Sol.**

2. Explain the structure of a typical monocot embryo.

**Sol.** Embryos of monocotyledons possess only one cotyledon. In the grass family the cotyledon is called scutellum that is situated towards one side of the embryonal axis. At its lower end, the embryonal axis has the radical and root cap enclosed in an undifferentiated sheath called coleorhiza. 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.

3. Write short note on "Surgical methods of a contraception".

**Sol.** Surgical methods, also called sterilisation, are generally advised for the male/female partner as a terminal method to prevent any more pregnancies. Surgical intervention blocks gamete transport and thereby prevent conception. Sterilisation procedure in the male is called 'vasectomy' and that in the female, 'tubectomy'. In vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum whereas in tubectomy, a small part of the fallopian tube is removed or tied up through a small incision in the abdomen or through vagina. These techniques are highly effective but their reversibility is very poor.

4. What is parthenogenesis? Give two examples from animals.

**Sol.** The development of a new individual from an unfertilised egg is called parthenogenesis. Parthenogenesis is a special mode of reproduction. It is simpler, easier as well as rapid mode of replication. However, it eliminates the chances of variation in a population so, it does not play important role in evolution process. Examples: Honeybees and some lizards.

5. Name the Indian hot spots that extend into other countries.

**Sol.** (i) Western Ghats and Sri Lanka.  
(ii) Indo-Burma and Himalaya.

6. How does smoking tobacco in human lead to oxygen deficiency in their body?

**Sol.** Smoking increases the carbon monoxide (CO) content in the blood which has greater affinity to haemoglobin than oxygen. CO forms a stable bond with haemoglobin and does not allow binding of oxygen. Smoking also damages alveolar walls, which reduces respiratory surface (emphysema).

7. (i) Define heterozygous.  
(ii) Define homozygous.

**Sol.** (i) **Define heterozygous:** When dissimilar or different pairs of alleles are present for a character, it is called heterozygous condition, e.g., Tt.  
(ii) **Define homozygous:** When similar pair of alleles are present for a character, it is called homozygous, e.g., TT.



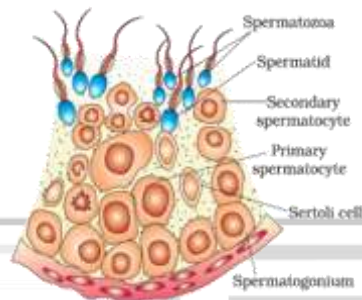
**8. Difference Coleoptile between Coleorrhiza.**

**Sol.**

Coleoptile	Coleorrhiza.
The shoot apex and few leaf primordia are enclosed in a hollow foliar structure in the epicotyl region in monocots and is called coleoptile.	The radicle and root cap are situated at the lower end of the embryonal axis into undifferentiated sheath called coleorrhiza.
It comes out of the soil.	It remains inside the soil.
It emerges from the soil, turns green and does photosynthesis.	It remains in the soil and is non-green in colour.

**9. Draw a diagrammatic sectional view of seminiferous tubule.**

**Sol.**



**Diagrammatic sectional view of a seminiferous tubule (enlarged)**

**10. Describe the method of artificial hybridization**

**Sol.** In artificial hybridisation only the desired pollen grains are used. This is achieved by emasculation and bagging techniques. In the female parent bears bisexual flowers, removal of anthers from the flower bud before the anther dehisces using a pair of forceps is necessary. This step is referred to as emasculation. Emasculated flowers have to be covered with a bag of suitable size, generally made up of butter paper to prevent contamination of its stigma with unwanted pollen. This process is called bagging. When the stigma of bagged collected from anthers of the male parent are dusted on the stigma and the flowers are rebagged and the fruits allowed to develop. If the female parent produces unisexual flowers, there is no need for emasculation. The female flower buds are bagged before the flowers open. When the stigma becomes receptive, pollination is carried out using the desired pollen and the flower rebagged. This is one of the major approaches of crop improvement programme.

**11. Give difference: Accessory whorls and essential whorls.**

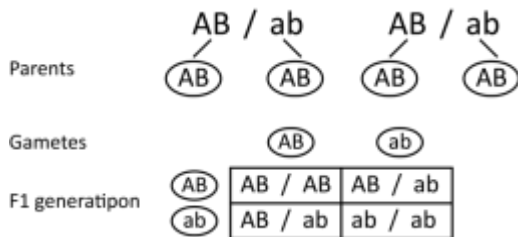
**Sol.**

Accessory Whorls	Essential whorls
The whorls of a flower which are not associated with sexual reproduction but helpful in that process are called accessory whorls.	The whorls of a flower which are associated with sexual reproduction are called essential whorls.
Calyx and corolla are accessory whorls.	Androecium and Gynoecium are essential whorls.
They have proper structure for pollination.	They induce sexual reproduction.
They are sterile whorls.	They are fertile whorls.

**12. Two heterozygous parents are crossed. If the two loci are linked what would be the distribution of phenotypic**

features in  $F_1$  generation for a dihybrid cross?

**Sol.** There will be reshuffling of chromosomes but no reshuffling of genes. Phenotypically dominants and recessives appear in the ratio of 3:1

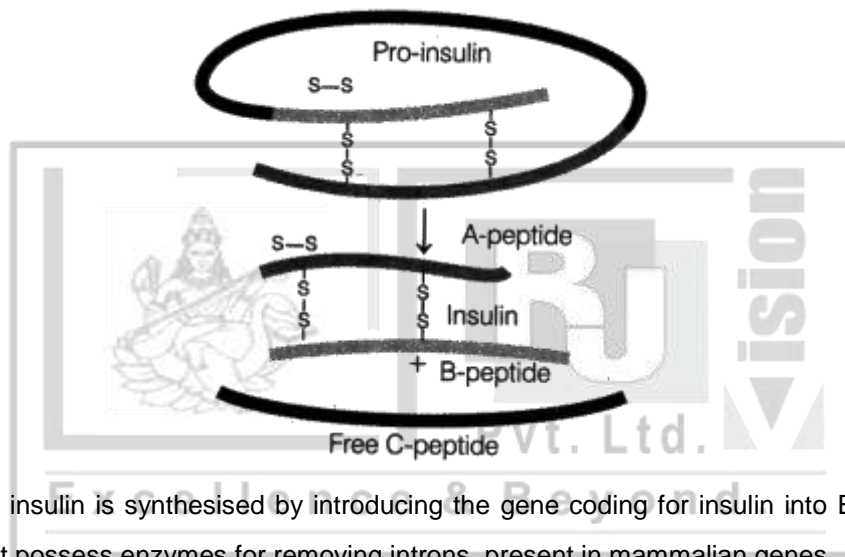


### SECTION – B [3 M]

Answer question No.13 to 21 as directed. Each question carry 3 marks. (Attempt any 6 out of 9)

[18]

13. Observe the diagram given below and answer the questions that follows



- Explain how insulin is synthesised by introducing the gene coding for insulin into E. Coli which is bacterium and does not possess enzymes for removing introns, present in mammalian genes.
- What was the main challenge for production of insulin using rDNA technique?

**Sol.**

- Insulin is produced by the  $\beta$ -cells of islets of Langerhans of the pancreas. In humans, insulin is synthesised as a prohormone which contains an extra stretch called as C-peptide. This C-peptide is not present in the mature insulin and is removed during maturation of the prohormone into insulin.
- The main challenge for production of insulin using rDNA technique was getting insulin assembled into a mature form. To solve this problem, two chains A and B of insulin were synthesised separately by inserting the respective genes encoding the chains in the E.coli. After extraction, these two chains were combined by creating disulphide bonds to form human insulin.

14. With a neat, labelled diagram, describe the parts of a typical angiosperm ovule.

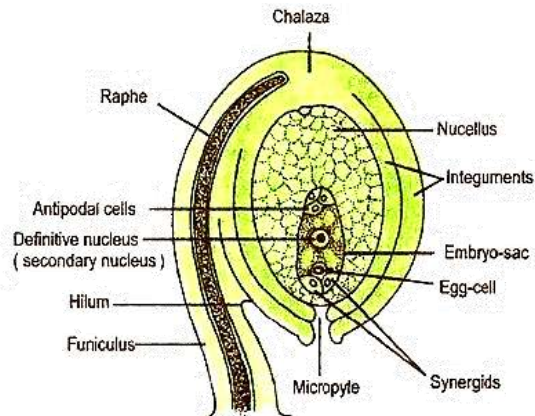
**Sol.** An angiospermic ovule is typically an ovoid and whitish structure. The ovule is stalked. The stalk is called Funiculus or funicle. So Depending upon the configuration and orientation of the body of ovule in relation to Funiculus, this typical ovule is anatropous.

The following are the parts of a typical angiosperm ovule:

- Funicle:** The ovule is attached to the placenta by a slender stalk called funicle. The point of attachment of the ovule to the funicle is hilum. Sometimes, the funicle extends beyond the Hilum forming a ridge called raphae.



- (ii) Integuments: The ovule become surrounded by two multicellular protective coverings or envelopes called integuments. This integument is incomplete at the apex called micropyle. The base of the ovule is called chalaza.



**Structure of a typical ovule (anatropous ovule)**

- (iii) Nucellus: The body of the ovule consists of parenchymatous tissue rich in reserve food material.  
 (iv) Embryo sac: It is centrally located female gametophyte embedded in the nucellus. It contains seven cells, i.e., three antipodal cells at chalazal end, three cells at micropylar end (of which two are synergids and one is egg cell) and a large central cell. The central cell contain two polar nuclei which fuse to form secondary nucleus.

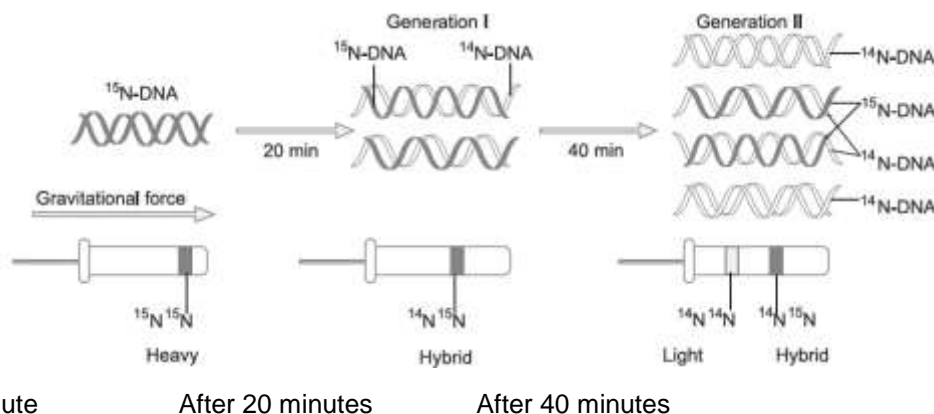
15. (a) Explain the observations of Meselson and Stahl when

- (i) They cultured *E. coli* in a medium containing  $^{15}\text{NH}_4\text{Cl}$  for a few generations and centrifuged the content.  
 (ii) They transferred one such bacterium to the normal medium of  $\text{NH}_4\text{Cl}$  and cultured for two generations.

- (b) What does the above experiment prove?  
 (c) Which is the first genetic material identified?

Sol.

- (a)  
 (i) Meselson and Stahl observed that in the *E. coli* bacterium, the DNA becomes completely labelled with  $^{15}\text{N}$  medium by centrifugation for few generations.  
 (ii) After two generations, density changed and showed equal amount of light DNA ( $^{14}\text{N}$ ) and dark hybrid DNA ( $^{15}\text{N}-^{14}\text{N}$ ).  
 (b) They concluded that DNA replicates semi-conservatively.



- (c) Ribonucleic acid (RNA) was the first genetic material.

16. Describe the process of waste water treatment under the following heads:

- (a) Primary treatment  
 (b) Secondary treatment

Sol. (a) **Primary treatment or physical treatment**

- It is the physical removal of large and small particles from sewage.
- First, the floating debris is removed by sequential filtration by passing through wire mesh screens.
- Then, the grit (soil and small pebbles) are removed by sedimentation in settling tanks. The sediment is called primary sludge and the supernatant is the effluent.
- The effluent is taken for secondary treatment.

**(b) Secondary treatment or biological treatment**

- Primary effluent is passed into large aeration tanks with constant mechanical agitation and air supply.
- Useful aerobic microbes grow rapidly and form flocs.
- Flocs are masses of bacteria associated with fungal filaments to form mesh-like structures.
- The growing microbes consume organic matter and thus reduce the biochemical oxygen demand (BOD).
- When BOD of sewage has reduced, the effluent is passed into settling tank.
- Here, the bacterial flocs settle and the sediment is called activated sludge.
- A small part of the sludge is used as an inoculum in the aeration tank and the remaining part is passed into large tanks called anaerobic sludge digesters.
- In the digesters, heterotrophic microbes anaerobically digest bacteria and fungi in sludge producing mixture of gases such as methane, hydrogen sulphide (H<sub>2</sub>S) and CO<sub>2</sub>, which form the biogas.
- Effluent is now released into rivers and streams.

17. What is Cancer? How is a cancer cell different from normal cell? How do normal cells attain cancerous nature?

Sol. An abnormal and uncontrolled division of cells is termed as cancer.

Cancer cell	Normal cell
Cancer cells divide in an uncontrolled manner.	Normal cells divide in a controlled manner.
These cells do not show contact inhibition.	These cells show contact inhibition.
Lifespan is indefinite.	Lifespan is definite.

In our body, the growth and differentiation of cells is highly controlled and regulated. The normal cells show a property called contact inhibition. The surrounding cell inhibits uncontrolled growth and division of a cell. The normal cells when lose this property, become cancerous, giving rise to masses of cells called tumours. Transformation of normal cells into cancerous cells is induced by some physical, chemical or biological agents (carcinogens).

18. Briefly describe the following:

- Transcription
- Polymorphism
- Translation
- Bioinformatics

Sol. (a) **Transcription:** It is the formation of RNA over the template of DNA. It forms single stranded RNA which has a coded information similar to the sense or coding strand of DNA with exception that thymine (T) is replaced by uracil (U). One strand of DNA is used as template (template strand) for the synthesis of a complementary strand of RNA called mRNA.

(b) **Polymorphism:** In This form of polymorphism there is variation in DNA at a given genomic site among individuals of a population. It is of two types (a) SNP (single nucleotide polymorphism). (b) VNTRs (variable number

tandem repeats) and (c) RFLM (Restriction fragment length polymorphism.).

(c) **Translation:** The process during which the genetic information (which is stored in the sequence of nucleotides in an mRNA molecule is translated, following dictations of the genetic code, into the sequence of amino acids in the polypeptide. It occurs in cytoplasm in both eukaryotes and prokaryotes.

(d) **Bioinformatics:** It is a combination of biology, information technology and computer science that deals with data storage, retrieval and analysis of sequences of basis in human genome using high speed computational devices.

This science is useful in organisation of biological data, functional genomics, proteomics and in diagnosis and treatment of diseases.

19. Give experimental proof that DNA replicates semi conservatively.

**Sol.** It is now proven that DNA replicates semi conservatively. It was shown first in *Escherichia coli* and subsequently in higher organisms, such as plants and human cells. Matthew Meselson and Franklin Stahl performed the following experiment in 1958:

(a) They grew *E. coli* in a medium containing  $^{15}\text{NH}_4\text{Cl}$  ( $^{15}\text{N}$  is the heavy isotope of nitrogen) as the only nitrogen source for many generations. The result was that  $^{15}\text{N}$  was incorporated into newly synthesised DNA (as well as other nitrogen containing compounds). This heavy DNA molecule could be distinguished from the normal DNA by centrifugation in a cesium chloride (CsCl) density gradient (Please note that  $^{15}\text{N}$  is not a radioactive isotope, and it can be separated from  $^{14}\text{N}$  only based on densities).

(b) Then they transferred the cells into a medium with normal  $^{14}\text{NH}_4\text{Cl}$  and took samples at various definite time intervals as the cells multiplied, and extracted the DNA that remained as double-stranded helices. The various samples were separated independently on CsCl gradients to measure the densities of DNA.

(c) Thus, the DNA that was extracted from the culture one generation after the transfer from  $^{15}\text{N}$  to  $^{14}\text{N}$  medium [that is after 20 minutes; *E. coli* divides in 20 minutes] had a hybrid or intermediate density. DNA extracted from the culture after another generation [that is after 40 minutes, II generation] was composed of equal amounts of this hybrid DNA and of 'light' DNA.

20. How do drugs affect the lifestyle of sports persons?

**Sol.** Misuse of drugs is what certain sport persons do to enhance their performance. They use narcotic analgesics, anabolic steroids, diuretics and certain hormones in sport to increase muscle strength and bulk and to promote aggressiveness and as a result increase athletic performance. The side effects of using anabolic steroids in females include masculinisation (features like male), increased aggressiveness, mood swings, depression, abnormal menstrual cycles, excessive hair growth on the face and body, enlargement of clitoris, deepening of voice. In males it includes acne, increased aggressiveness, mood swings, potential for kidney and liver dysfunction, breast enlargement, premature baldness, enlargement of the prostate gland. These effects may be permanent with prolonged use, in the adolescent male or female, severe facial and body acne. Premature closure of the growth centres of the long bones may result in stunted growth.

21. Mention the detection and treatment of Cancer.

**Sol.** **Detection:** Early detection of cancers is essential as it allows the disease to be treated successfully in many cases. Cancer detection is based on biopsy and histopathological studies of the tissue and blood and bone marrow tests for increased cell counts in the case of leukemias. In biopsy, a piece of suspected tissue is cut into thin sections is stained and examined under microscope by a pathologist. Technique like radiography (use of X-rays), Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) are very useful to detect cancers of internal organs. Computed tomography uses X-rays to generate a three dimensional image of the internals of an object. MRI uses strong accurately detect pathological and physiological changes in living tissues.

**Treatment:** The common approach for treatment of cancer is surgery, radiation therapy and immunotherapy. In radiotherapy tumor cells are irradiated lethally, taking proper care of the normal tissues surrounding the tumor mass. Several chemotherapeutic drugs are used to kill cancerous cells. Some of these are specific for particular tumors. Majority of drugs have side effects like hair loss, anaemia, etc. most cancers are treated by combination of surgery, radiotherapy and chemotherapy. Tumor cells have been shown to avoid detection and destruction by immune system. Therefore patients are given substances called biological response modifiers such as  $\alpha$ -interferons which activates their immune system and helps in destroying the tumor.

#### **SECTION – C [4 M]**

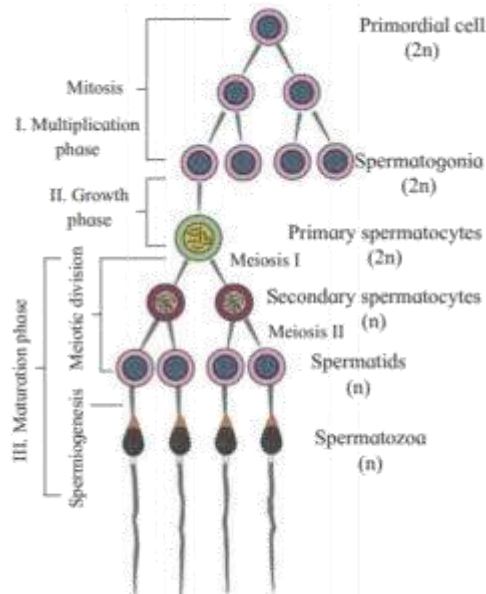
**Answer question No. 22 to 27 as directed. Each question carry 4 marks. (Attempt any 4 out of 6)**

**[16]**

**22.** What is spermatogenesis? Briefly describe the process of spermatogenesis.

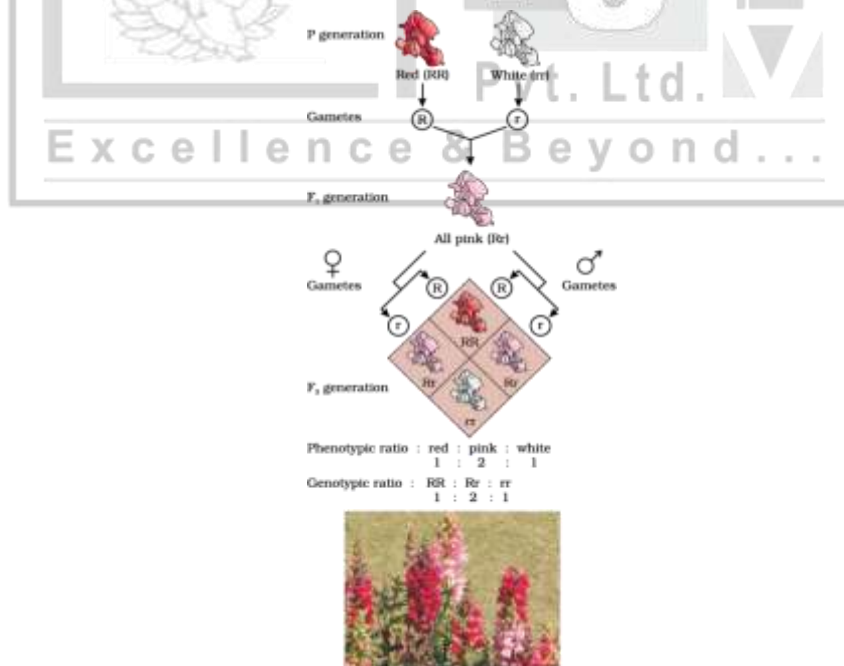
**Sol.**

- ❖ In testis, the immature male germ cells(spermatogonia) produce sperms by spermatogenesis that begins at puberty.
- ❖ The spermatogonia (sing. spermatogonium) present on the inside wall of seminiferous tubules multiply by mitotic division and increase in numbers.
- ❖ Each spermatogonium is diploid and contains 46 chromosomes. Some of the spermatogonia called primary spermatocytes periodically undergo meiosis.
- ❖ A primary spermatocyte completes the first meiotic division (reduction division) leading to formation of two equal, haploid cells called secondary spermatocytes, which have only 23 chromosomes each.
- ❖ The secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids
- ❖ The spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis.
- ❖ After spermiogenesis, sperm heads become embedded in the Sertoli cells, and are finally released from the seminiferous tubules by the process called spermiation.
- ❖ Spermatogenesis starts at the age of puberty due to significant increase in the secretion of gonadotropin releasing hormone (GnRH).
- ❖ Luteinising hormone (LH) and follicle stimulating hormone (FSH). LH acts at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens, in turn, stimulate the
- ❖ process of spermatogenesis. FSH acts on the Sertoli cells and stimulates add figure from



23. Explain the following term with example: Incomplete dominance.

**Sol. Incomplete dominance.** In Mendel's experiments,  $F_1$  offspring always resembled with one of the two parents because complete dominance of one allele over the other. However, for some traits the  $F_1$  phenotype is intermediate between those of the parental traits. It is known as '**incomplete dominance**'. Thus, the incomplete dominance is the phenomenon where none of the contrasting factors (alleles) is dominant and the expression of the trait in  $F_1$  offspring (hybrids) is intermediate or a fine mixture of the expression of the two factors.



- **In snapdragon** (*Antirrhinum majus*) and **4 o'clock plant** (*Mirabilis jalapa*), there are two types of flower colour in pure state. A cross between varieties with red and white flowers produces all pink flowered  $F_1$  progeny. The  $F_1$  when selfed, gives  $F_2$  progenies which are red, pink and white in the ratio of 1 : 2 : 1. Here, the pink have heterozygous phenotype. Thus, the phenotypic and genotypic ratios are the same in the case of incomplete dominance.
- Incomplete dominance is not an example of pre-Mendelian concept of blending inheritance because the parental types reappear in the  $F_2$  generation, which would not be possible if blending truly occurred. The alleles



of the gene (for flower colour) are therefore, discrete or particulate.

**24.** Explain the mechanism of DNA replication as suggested by Watson and Crick.

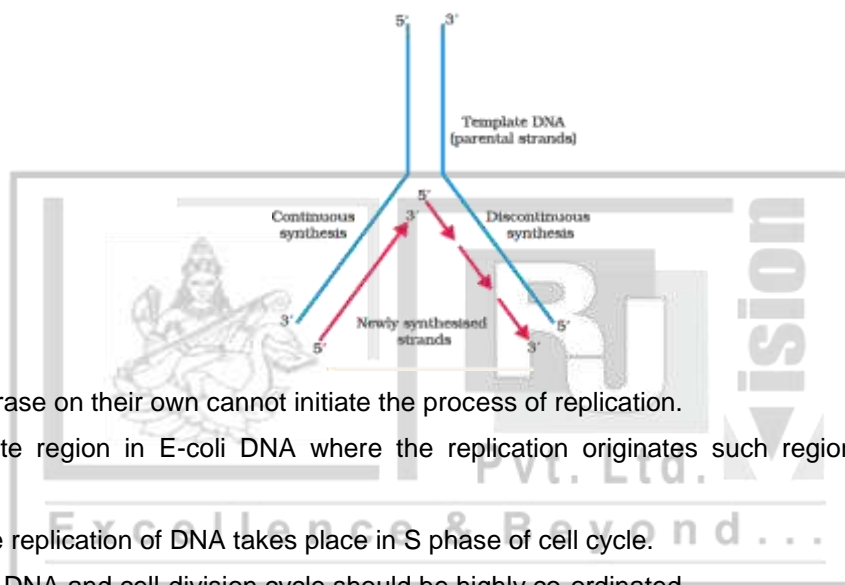
**Sol.** The two strands of DNA would separate and act as a template for the synthesis of new complimentary strands. After the completion of replication each DNA molecule would have one parental and one newly synthesised strand. This scheme was termed as semi-conservative replication of DNA.

In living cells such as E-coli the process of replication requires a set of enzymes. The main enzyme is referred to as DNA dependent DNA polymerase, since it uses a DNA template to catalyse the polymerization of deoxy nucleotides. Furthermore energetically, replication is a very expensive process deoxy ribonucleoside tri-phosphates serve dual purposes. In addition to acting as substrates, they provide energy for polymerization reaction.

For long DNA molecules since the two stands of DNA cannot be separated in its entire length, the replication occurs within a small opening of the DNA helix referred to as replication fork.

The DNA dependent DNA polymerases catalyse polymerization only in one direction that is  $5' \rightarrow 3'$ .

Consequently on one strand the replication is continuous while on the other strand it is discontinuous. The discontinuously synthesised fragments are later joined by the enzyme called DNA ligase.



The DNA polymerase on their own cannot initiate the process of replication.

There is a definite region in E-coli DNA where the replication originates such regions are known as origin of replication.

In eukaryotes, the replication of DNA takes place in S phase of cell cycle.

The replication of DNA and cell-division cycle should be highly co-ordinated.

A failure in cell division after DNA replication results into polyploidy.

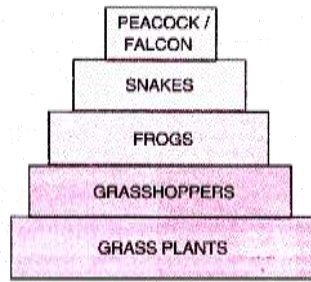
**25.** Define ecological pyramids and describe with examples, pyramids of number and biomass.

**Sol.** An ecological pyramid is a graphic representation of an ecological parameter, like bio-mass energy or number of individuals present in various trophic levels of a food chain with producers forming the base and top carnivores the tip. Each trophic level represents a functional level. Therefore, it includes all the members of all the species operating at that level.

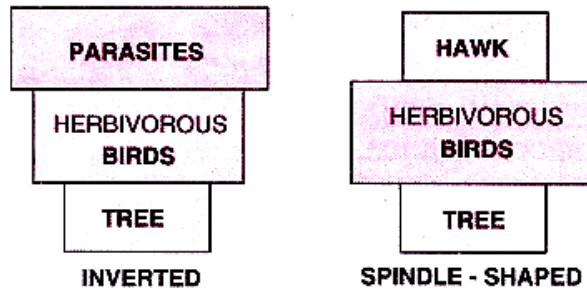
**(1) Pyramid of Numbers :** It is a graphic representation of the number of individuals per unit area of various trophic levels stepwise with producers being kept at the base and top carnivores kept at the tip.

- ❖ It is generally upright with producers population (e.g., grass plants, phytoplankton) being the largest. Producers support fewer herbivores (e.g., Grasshoppers, zooplankton).
- ❖ The number of primary carnivores (e.g., frogs, smaller fish) is still smaller. The number of higher order carnivores is very small.
- ❖ However, if the producer is large-sized like a tree, the pyramid of numbers can be inverted or spindle-shaped. A tree may support many herbivorous birds that may carry a large number of parasites or feed one or two hawks.





(pyramid of number in terrestrial ecosystem)



(Abnormal pyramid of Numbers of tree ecosystem)

**(2) Pyramid of Biomass :** The amount of living organic matter is called biomass. It is measured both as fresh and dry-weight. pyramid of biomass is a graphic representation of biomass present sequence-wise per unit area of different trophic levels with producers at the base and top carnivores kept at the tip.

- ❖ pyramid of biomass is generally upright with maximum biomass present in producers followed by lesser biomass in herbivores and still small biomass in carnivores. Only 10-20% biomass is transferred from lower trophic to its higher trophic level.
- ❖ However, inverted or spindle-shaped pyramid of biomass is found in aquatic habitats due to smaller biomass of phytoplankton at the time because its members have a short life span but very high reproductive potential.



(pyramid of biomass)

(pyramid of biomass of aquatic system)

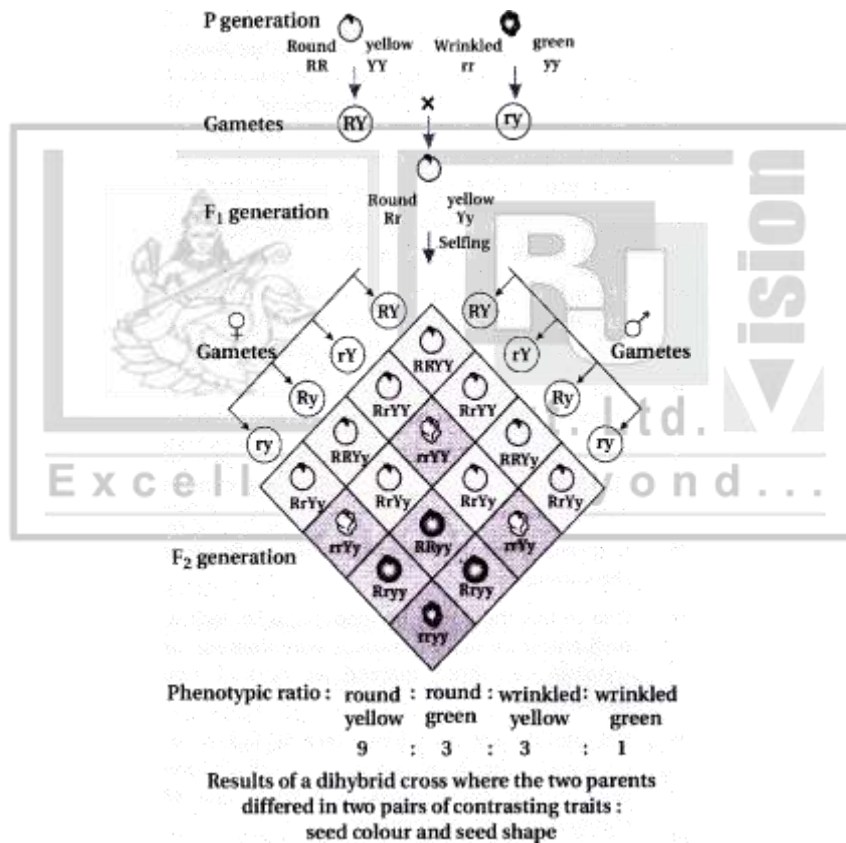
26. Write a note on lymphoid organs.

**Sol. Lymphoid organs:** These are the organs where origin and/or maturation and proliferation of lymphocytes occur. The primary lymphoid organs are bone marrow and thymus where immature lymphocytes differentiate into antigen-sensitive lymphocytes. After maturation the lymphocytes migrate to secondary lymphoid organs like spleen, lymph nodes, tonsils, Peyer's patches of small intestine and appendix. The secondary lymphoid organs provide the sites for interaction of lymphocytes with the antigen, which then proliferate to become effector cells. The bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced. The thymus is a lobed organ located near the heart and beneath the breastbone. The thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained it reduces to a very small size. Both bone-marrow and thymus provide micro-environments for the development and maturation of T-lymphocytes. The spleen is a large bean shaped organ. It mainly contains lymphocytes and phagocytes. It acts as a filter of the blood by trapping blood-borne microorganisms. Spleen also has a large reservoir of erythrocytes. The lymph nodes are small solid

structures located at different points along the lymphatic system. Lymph nodes serve to trap the micro-organisms or other antigens, which happen to get into the lymph and tissue fluid. Antigens trapped in the lymph nodes are responsible for the activation of lymphocytes present there and cause the immune response. There is lymphoid tissue also located within the lining of the major tracts (respiratory, digestive and urogenital tracts) called mucosa associated lymphoid tissue (MALT). It constitutes about 50 per cent of the lymphoid tissue in human body.

27. Describe inheritance of two gene with the help of punnett square.

Sol. Mendel also worked with and crossed pea plants that differed in two characters as is seen in the cross between a pea plant that has seeds with yellow colour and round shape and one that had seeds of green colour and wrinkled shape. Mendel found that the seeds resulting from the crossing of the parents had yellow coloured and round shaped seeds. Thus yellow colour was dominant over green and round shape dominant over wrinkled. These results were identical to those that he got when he made separate monohybrid crosses between yellow and green seeded plants and between round and wrinkled seeded plants. Let us use the genotypic symbols 'Y' for dominant yellow seed colour and 'y' for recessive green seed colour, R for round shaped seeds and r for wrinkled seed shape. The genotype of the parents can then be written as RRYy and rryy. The cross between the two plants can be written down as in the given figure showing the genotypes of the parent plants.



The gametes RY and ry unite on fertilisation to produce the F<sub>1</sub> hybrid RrYy. When Mendel self hybridised the F<sub>1</sub> plants he found that 3/4<sup>th</sup> of F<sub>2</sub> plants had yellow seeds and 1/4<sup>th</sup> had green. The yellow and green colour segregated in a 3 : 1 ratio. Round and wrinkled seed shape also segregated in a 3 : 1 ratio; just like in a monohybrid cross.