

2023 12 22

TS-B1

SEAT NUMBER



**IIT INSPIRE**  
**ACADEMY OF SCIENCE**  
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XI & XII Science (CBSE/state)  
IIT- JEE (Mains + Advance)

NEET, MH-CET , NDA

Mo. No. 9595445177/9021445177

Branches : Chhatrapati Sq., Mangalmurti Sq.

4

(4 Pages)

calculator is not allowed.

5. All symbols having their usual meanings unless otherwise stated.

6. For each MCQ, correct answer must be written along with its alphabet.

7. Evaluation of each MCQ would be done for the first attempt only.

**SECTION-A**

**Q.1 Select and write the correct answers to the following questions:**

**[10]**

- 1)Hypersecretion of STH in children cause \_\_\_\_\_  
**c) gigantism** (1)
- 2)Pruning Of plants promotes branching due to sensitization of axillary buds by \_\_\_\_\_  
**d) IAA** (1)
- 3)One of the following trait is dominant in Pisum sativum \_\_\_\_\_  
**d) Inflated pods** (1)
- 4)Identify the animal having open circulation \_\_\_\_\_  
**a) Butterfly** (1)
- 5)The coding sequences in split genes are called \_\_\_\_\_  
**b) Exons** (1)
- 6)Scrotum acts as \_\_\_\_\_  
**c) thermoregulator** (1)
- 7)Opium derivative is \_\_\_\_\_  
**c) Heroin** (1)
- 8)Loss of memory may result from injury to \_\_\_\_\_  
**d) Cerebrum** (1)
- 9)\_\_\_\_\_ waves in ECG represents atrial depolarization.  
**a) P** (1)
- 10) In Calotropis self-pollination is avoided by \_\_\_\_\_

**d) Herkogamy** (1)

**Q.2 Answer the following questions in one sentence:** [8]

(1) **Define Immunity.** (1)

**Ans:**

Immunity: It is defined as the general ability of the body to recognize, neutralize/destroy and eliminate foreign substances or resist a particular infection or disease.

(2) **Use of biofertilizer is cost effective and ecofriendly. Give reason** (1)

**Ans:**

Biofertilizer play a vital role to maintain long term fertility and sustainability. They are biological origin, hence cheap and non-polluting, thereby cost effective and eco-friendly.

(3) **Expand OECD.** (1)

**Ans:**

Organization for Economic Cooperation and Development.

(4) **What is climax community?** (1)

**Ans:**

Climax community is the last and final stable community that is established in an area during ecological succession.

(5) **Enlist the different levels of biodiversity.** (1)

**Ans:**

The major hierarchical and interrelated levels of biodiversity are; genetic diversity, species diversity (community) and ecosystem diversity (ecological).

(6) **State the location of CNS in our body.** (1)

**Ans:**

The CNS is located along the mid dorsal axis of the body.

(7) **State the ploidy level of megasporocyte and secondary nucleus.** (1)

**Ans:**

Ploidy level of megasporocyte and secondary nucleus is  $2n$

(8) **What is cryptorchidism?** (1)

**Ans:**

The failure of the testis to descend into the scrotum is called cryptorchidism. It results in sterility.

### **SECTION-B**

**Attempt any eight of the following questions:** [16]

**Q.3 Enlist the adaptations of wind pollination.** (2)

**Ans:**

**Anemophily:** The transfer of pollen grains through wind is called anemophily. Most of the important crop plants are wind pollinated. These include wheat, rice, rye, barley and oats. Palms are also wind pollinated.

**Adaptations in anemophilous flowers:**

1. The flowers are small, inconspicuous, colourless, without nectar and fragrance (odour).
2. The pollen grains are light in weight, dry and produced in large numbers to increase chance of pollination considering wastage of pollen grains.
3. Stigma is feathery to trap pollen carried by wind currents.

4. Stamens are exerted with long filaments and versatile anthers.
5. Stamens and stigmas are exposed to air currents.

**Q.4 Enlist the significance of fallopian tube. (2)**

**Ans:**

1. Collects eggs from the surface of ovaries.
2. Transfers the ovum from ovaries to uterus by ciliary and peristalsis.
3. It provides site for fertilization of eggs and cleavage.

**Q.5 Write a note on genetic recombination. (2)**

**Ans:**

1. In sexually reproducing organisms, during gamete formation, exchange of genetic material occurs between non-sister chromatids of homologous chromosomes. This is called crossing over.
2. It produces new genetic combinations which result in variation.
3. Fertilization between opposite mating gametes leads to various recombination resulting into the phenotypic variation causing change in the frequencies of alleles.

**Q.6 Explain the physiological effect of cytokinins. (2)**

**Ans:**

1. **Cell division:** Cytokinins promote DNA synthesis and cell division. During callus formation, auxin and cytokinin rate of mitosis.
2. **Tissue differentiation:** During callus formation, cytokinin and auxin accelerate the rate of mitosis. A balanced combination of cytokinin and auxin is useful for inducing organogenesis. More auxins (shoot formation) . Chloroplast formation is also initiated by cytokinin in presence of light.
3. **Delayed senescence:** Degradation of an organ is called senescence. Application of cytokinins prevent degradation of metabolites or promote their synthesis, hence delays senescence. This is called Richmond-Lang effect.
4. **Counteraction of apical dominance:** Activity of cytokinins is opposite to that of auxins in relation to apical dominance. Cytokinins stimulate the growth of lateral buds.
5. **Initiative of interfascicular cambium:** It has been found that in pea, during secondary growth of plant, cytokinins induces formation of interfascicular cambium between vascular bundles.

**Q.7 Write a short note on palindrome. (2)**

**Ans:**

1. A palindrome is a sequence of base nuclei and pairs that reads same on the complementary strands when orientation of reading is kept the same.
2. The following sequences read the same on the two strands in 5' -3' direction and is true if remain the 3' -5' direction.  
5' - GAATTC - 3'  
3' - CTTAAG - 5'.

**Q.8 Match the columns.**

**(2)**



Column 'A' Biofortified crop	Column 'B' Nutritive Value
(i) Fortified Maize	(a) High protein content
(ii) Wheat – Atlas 66	(b) Vitamin A and minerals
(iii) Fortified carrot and spinach	(c) Vitamin C
(iv) Fortified bitter gourd and tomato	(d) Twice the amount of lysine and typtophan.

**Ans:**

(I – d); (ii – b); (iv – c)

**Q.9 Differentiate between T - Cell and B - Cell.**

(2)

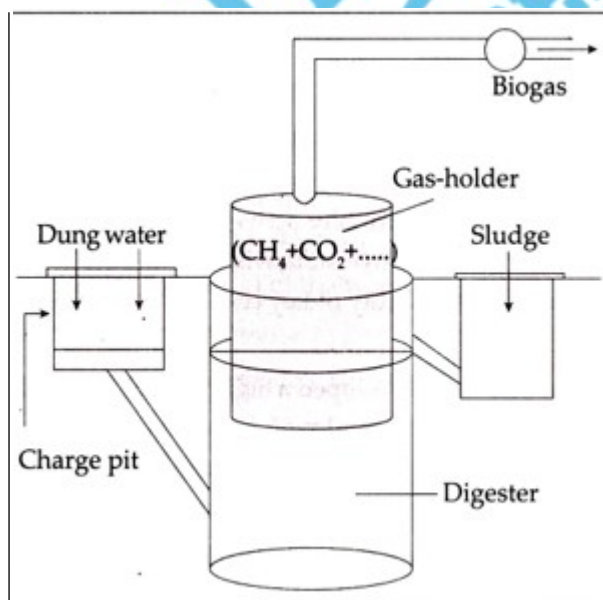
**Ans:**

T – Cell	B – Cell
(i) These are T-lymphocytes.	(i) These are B-lymphocytes.
(ii) They attain maturity in Thymus gland.	(ii) They attain maturity in Bone marrow.
(iii) Move to the site of infection.	(iii) Does not move to the site of infection.
(iv) Secrete lymphokines.	(iv) Secrete antibodies.
(v) Lack surface antigen.	(v) Have surface antigen.
(vi) Recognise viral antigen on the outside of the infected cells.	(vi) Recognise antigens on the surface of bacteria and virus.
(vii) Have 3 types – T-helper, T-killer, T-suppressor cells.	(vii) Have two types – Plasma cells and memory cells.
(viii) Acts against tumor cells or transplants.	(viii) Do not act against tumor cells or transplants.
(ix) Have inhibitory effect on immune system.	(ix) Do not have inhibitory effect on immune system.

**Q.10 Sketch and label biogas plant.**

(2)

**Ans:**



**Q.11 An orchid plant is growing on the branch of mango tree. How do you describe this interaction between the orchid and mango tree?**

(2)

**Ans:**

An orchid growing on mango tree is an example of “commensalism” type of interaction. In this type, orchid – an epiphyte gets the benefit (support) from mango tree branches; and mango tree remain neutral – i.e., neither benefitted nor harmed.

**Q.12 Describe various components of the ecosystem.**

**(2)**

**Ans:**

The ecosystem consists of the following two components.

1. Abiotic components: This includes all the inorganic substances like, Ca, Mg, Fe, P, S, C, N; organic components such as proteins, lipids, carbohydrates. Air, Water and soil also form the abiotic component.
2. Biotic components: These include the living organism of an ecosystem. These organisms may be autotrophic (plants, chemosynthetic, photosynthetic microorganisms) or heterotrophic (herbivores / carnivores). Heterotrophs may be macroconsumer like herbivores, carnivores and omnivores or micro consumers like decomposers

**Q.13 Explain briefly genetic diversity.**

**(2)**

**Ans:**

1. It is the intraspecific diversity.
2. It is the diversity in the number and types of genes as well as chromosomes present in different species and also the variation in the genes and their alleles in the same species.
3. Genetic diversity enables population to adapt to environment and the changes occurring in the environment.
4. Genetic variations lead to individual differences within the species.
5. Such variations pave the way to evolution.

**Q.14 Define the following: (a) Eurythermal organism (b) Stenothermal organism.**

**(2)**

**Ans:**

**(A) Eurythermal organisms:** Organisms that can tolerate and thrive in a wide range of temperatures are eurythermal organisms e.g., mammals and birds.

**(B) Stenothermal organism:** Organisms that can tolerate narrow range of temperature are called stenothermal organisms e.g., polar bears, Lizards, amphibian.

### **SECTION-C**

**Attempt any eight of the following questions:**

**[24]**

**Q.15 Why does our immune system fail against pathogens like the disease caused by Trypanosoma and Plasmodium.**

**(3)**

**Ans:**

1. The disease caused by Trypanosoma and Plasmodium are Trypanosomiasis and Malaria
2. Malaria parasites transform itself to hide from human immune system. To evade the human immune system and enter red blood cells, a normally active gene in malaria parasite nucleus goes into silent state – then switch back to active state when immunity wanes. Plasmodium the parasite responsible for malaria, impairs the ability of key cells of the immune system to trigger an efficient immune response.
3. In the same way African Trypanosomes have developed a highly sophisticated and complex system of antigenic variation. The almost unlimited capacity or antigenic

variation of the surface glycoproteins by the African trypanosome's in the major hurdle for good by the body.

- Thus, by hiding from the immune system or by impairing it, these pathogens fail the immune system of the host.

**Q.16 Describe the different actions of gaseous natural plant hormone in plants. (3)**

**Ans:**

**Name of the gaseous plant hormone is ethylene.**

- Promotes ripening:** It promotes ripening of fruits like Bananas, apples and mangoes.
- Breaks seed dormancy:** It stimulates initiation of lateral root in plants and breaks the dormancy of bud and seed.
- Abscission:** It accelerates the abscission activity in leaves, flowers and fruits by forming of abscission layer.
- Apical dominance:** Ethylene inhibits the growth of lateral buds and causes apical dominance and retards flowering.
- Senescence:** It is associated with the enhancement of process of senescence of plants organs.
- Drooping:** It causes epinasty (drooping) of leaves and flowers.
- Degreening:** It increases activity of chlorophyllase enzyme causing Degreening effect in banana and citrus fruits.

**Q.17 Differentiate between Neanderthal man & Cro-Magnon man. (3)**

**Ans:**

Neanderthal man	Cro - magnon man
(i) Cranial capacity is 1450 CC	(i) Cranial capacity is 16000 CC
(ii) They appeared about 1,50,000 to 25,000 years ago	(ii) They appeared about 50,000 to 20,000 years ago
(iii) These evolved from Homoerectus	(iii) These evolved from Neanderthal man
(iv) Lived in Neanderthal valley in Germany	(iv) Lived in Cro - magnon in France
(v) Forehead was low and slanting	(v) Forehead was rounded
(vi) No chin	(vi) Distinct chin
(vii) Prominent brow ridges	(vii) Thin brow ridges
(viii) Height 5'4"	(viii) Height $5\frac{1}{2}$ feet
(ix) Language was developing	(ix) Larynx became large & good language was developed

**Q.18 Enlist the applications of transgenic animals. (3)**

**Ans:**

Transgenic animals have the following roles.

- In medical research, transgenic animals help to identify the functions of specific factors in complex homeostatic system through over or under expression of modified gene (inserted transgene)
- In toxicology, a responsive test animal to detect toxicants.
- In mammalian developmental genetics.
- In molecular biology, analysis of the regulation of gene expression makes use of the evaluation of a specific genetic change at the level of the whole animal.



- In pharmaceutical industry, to produce pharmaceutical proteins, drugs and product efficacy testes.
- In biotechnology, they produce specific proteins.
- Genetically engineered hormones, increased yield of milk, meat production, genetic engineering of livestock and aqua culture modifies animal physiology and/or anatomy, cloning procedures to produce specific blood lines.
- Develop animals, specifically created for xenografting. (Tissue graft/organ transplant).

**Q.19 Write short note on chromosomes.**

**(3)**

**Ans:**

Chromosomes are filamentous structure present in the eukaryotic nucleus. A chromosome contains genes which determine traits.

The size of the chromosome varies from species to species.

Each metaphase chromosome ranges from 0.1 – 33  $\mu\text{m}$  in length and 0.2 –  $\mu\text{m}$  in thickness.

During interphase chromosome are seen in the form of chromatin network. During prophase, chromosomes appear thread like. During metaphase, chromosomes appear short and thick. Chemically chromosomes are made up of DNA, histone and non-histone proteins. Chromosomes are capable of self-replication and play a vital role in heredity, mutation variation and evaluation.

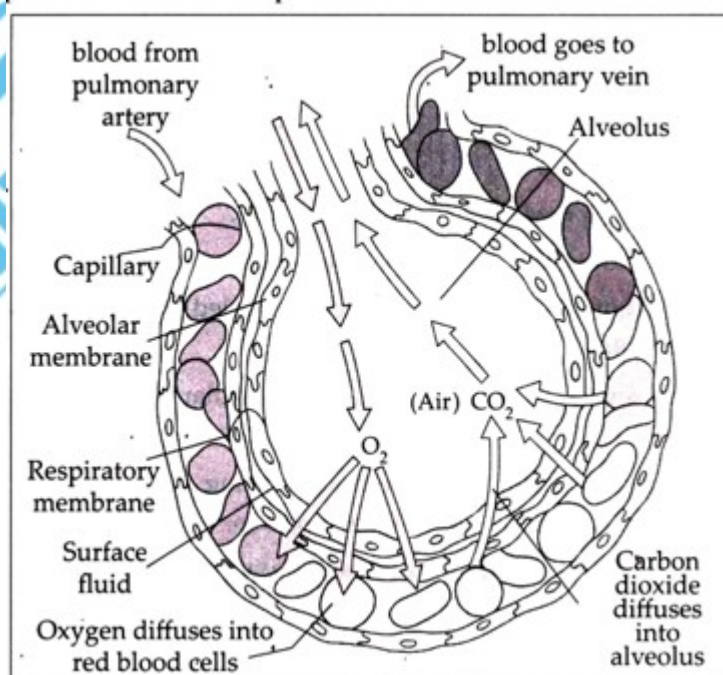
**Q.20 Explain the exchange of gases at alveolar the level.**

**(3)**

**Ans:**

Mechanism of respiration = External Respiration

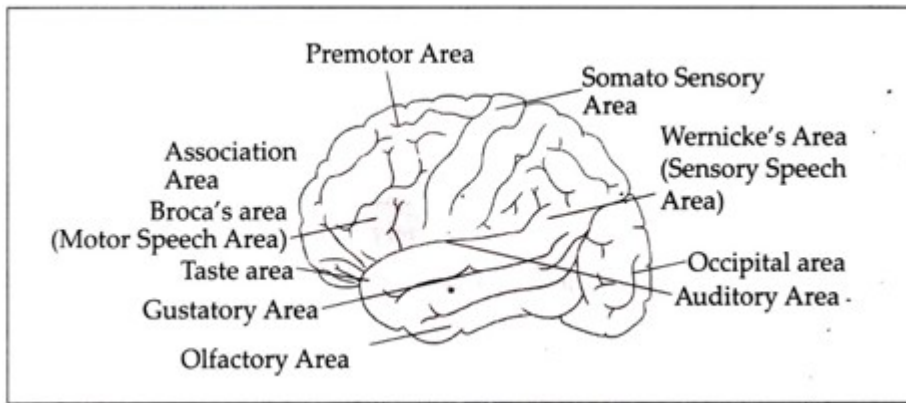
- Alveolus consists of layer of simple squamous epithelium resting on a basement membrane
- The capillary wall is made of squamous epithelium resting on basement membrane
- Both layers have similar structure and are thin walled. Together they make up the respiratory membrane. Through which gaseous exchange occurs i.e., between alveolar air and blood.
- Diffusion of gases will take place from an area of higher partial pressure to an area of lower partial pressure until the partial pressure in the two region reaches equilibrium.
- The partial pressure of carbon dioxide of blood entering the pulmonary capillary is 45 mmHg while partial pressure of Carbon dioxide in alveolar air is 40 mmHg.
- Due to this difference, carbon dioxide diffuses from the capillary into the alveolus.
- Similarly, partial pressure of oxygen of blood in pulmonary capillaries is 40 mmHg while in the alveolar blood it is 104 mmHg
- Due to this difference oxygen diffuses from alveoli to the capillaries.



**Q.21 Name, Sketch, label & explain the largest structure of brain in man.**

**(3)**

**Ans:**



**Position:**

It is the largest part of the brain comprising 80-85% of the total weight of brain.

**Structure:**

1. It is incompletely divided into two cerebral hemispheres by a median longitudinal fissure.
2. The hemispheres are connected to each other by a transvers bridge of nerve fibres called corpus callosum (corpus – body, callosum – bridge). It is the largest commissure in human brain.
3. Each cerebral hemisphere has a cavity called the lateral ventricle. These contain the CSF.
4. On the cut section cerebrum shows:
  - (a) Cerebral cortex: It is outer area made up of grey matter.
  - (b) Cerebral medulla: It is the inner area made up of white matter.
5. The surface of the cortex (root of cerebral hemisphere) is called pallium. The ventrolateral thick walls are called corpora striata. It is highly folded to form several elevations called gyri (singular – gyrus) and depressions called sulci (singular – sulcus).
6. Three of the sulci i.e. central sulcus, lateral sulcus and Parieto-occipital sulcus are deep and they divide the hemisphere into 4 lobes i.e.
  - Frontal lobe (anterior)
  - Parietal lobe (middle)
  - Occipital lobe (posterior)
  - Temporal lobe (lateral)
  - Functional areas of cerebrum:
    - The cerebrum shows various functional areas.
    - Frontal lobe: It consist of
      - a. General motor area: It controls the voluntary activities.
      - b. Motor speech area/Broca's area: It translates thought into speech. It control movements of tongue, lips and vocal cords.
      - c. Association area: It is the area controlling intelligence, memory, judgement, problem solving ability, etc.
    - Parietal lobe:
      - General sensory area: Receives impulses of touch, temperature, pain and pressure.
    - Occipital lobe:
      - Visual sensory association area: It receives and analyses impulses for vision.
    - Temporal lobe:
      - a. Wernicke's area: It is the sensory speech area.
      - b. Auditory area: It receives impulses for hearing.
      - c. Olfactory area: It receives impulses for sense of smell.
      - d. Gustatory area: It receives impulses of test sensation.



**Q.22 Sketch, label and describe the regions of root.**

**(3)**

**Ans:**

**Typical root shows the following 4 regions**

**1. Root cap:**

Root cap is a thickened protective cap like structure present at the tip of the root apex.

**2. Zone of cell division (Meristematic zone):**

A small region present behind the root cap. It represents growing point made up thin cells with large prominent nucleus.

**3. Zone of elongation:**

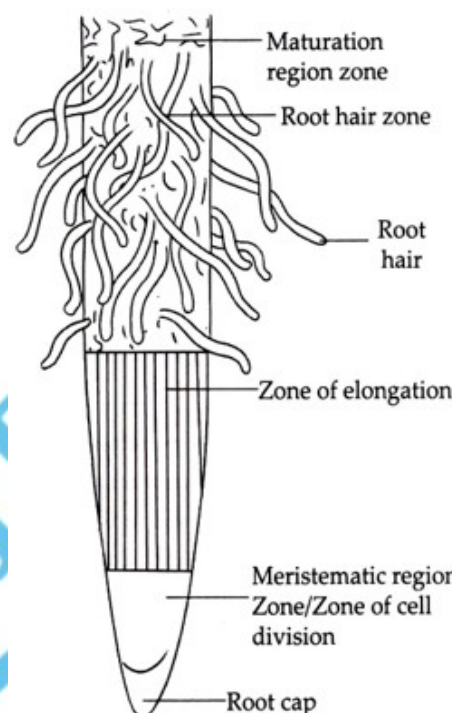
Zone of elongation is just above the meristematic zone. These cells do not divide but elongate rapidly.

**4. Zone of root hair:**

Possesses many root hairs which increase area of absorption of water.

**5. Zone of maturation:**

Is just above the root hair zone. It has no functions in absorption.



**Q.23 Are pollination and fertilization necessary in apomixis.**

**(3)**

**Ans:**

No, Pollination and fertilization are not necessary. Justification: Apomixis is actually an alternative to sexual reproduction although the female sexual apparatus is used in the process. In apomixis the embryo can develop directly from nucellus or egg synergids hence there is no pollination and fertilization required.

**Q.24 Explain the process of fertilization in angiosperms. State its significance**

**(3)**

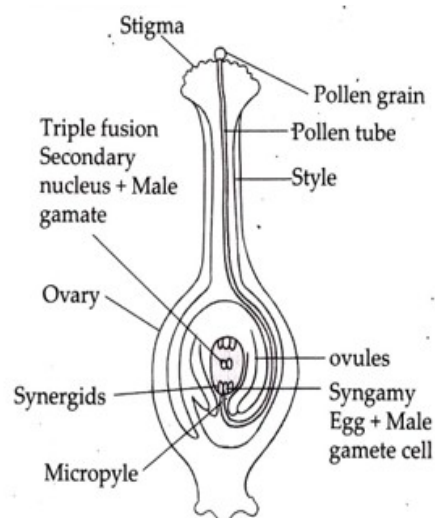
**Ans:**

1. Double fertilizations a complex fertilization mechanism in flowering (angiospermic) plants. It was discovered by Nawaschin in the liliaceous plants like Lilium and Fritillaria.

2. After a pollen grain has reached the surface of the stigma, it germinates and forms a pollen tube, which presents the stigma, style, ovary chamber and then enters ovule.

3. The growth of pollen tube is guided by the chemicals secreted by the synergids. It usually enters ovule through the micropyle. It is termed as porogamy. But in some cases, it is found to enter through chalaza, known as chalazogamy and in some plants by piercing the integuments, called mesogamy. Finally, it penetrates embryo sac of ovule through its micropylar end.

4. The pollen tube carrying male gametes penetrates in one of the synergids. Watery contents of synergid is absorbed by pollen tube which then ruptures and releases the contents, including the two non-motile



male gametes. As non-motile male gametes are carried through hollow pollen tube, it is known as siphonogamy that ensure fertilization to take place.

5. Syngamy and triple fusion are two event of sexual reproduction in angiosperms or flowering plants. Syngamy I the fusion of haploid male gamete with haploid female gamete (egg) to produce a diploid zygote, whereas in triple fusion, second haploid male gamete fuses with diploid secondary nucleus producing primary endosperm nucleus (PEN) that develops into triploid endosperm.
6. The zygote develops into an embryo. Syngamy is a type of generative fertilization whereas triple fusion is a type of vegetative fertilization. Here, both the male gametes participate and therefore, it is described as or called double fertilization.

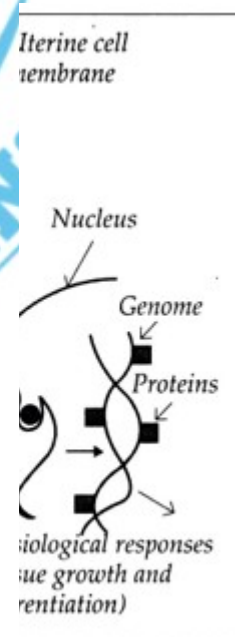
**Q.25 Explain the mode of action of steroid hormone.**

**(3)**

**Ans:**

The mode of action of the steroid hormone is through intracellular receptors.

1. The steroid and thyroid hormones are lipid soluble.
2. These hormones easily pass into cytoplasm through the plasma membrane of target cells.
3. In the cytoplasm they bind to specific intra cellular receptor protein forming a hormone receptor complex which enters the nucleus.
4. In the nucleus, these complex binds to specific regulatory site of DNA.
5. The activated genes transcribe mRNA which directs protein synthesis and enzymes in the cytoplasm.
6. Action of lipid soluble hormones is slower but long lasting.



**Q.26 Differentiate between Spermatogenesis and Oogenesis**

**(3)**

**Ans:**

Spermatogenesis	Oogenesis
(i) It takes place in mature and fertile males in testes.	(i) It takes place in mature and fertile female in ovary.
(ii) One spermatogonium forms four haploid sperms.	(ii) One oogonium forms only one ovum.
(iii) Metamorphosis of spermatids takes place to form sperms.	(iii) No such metamorphosis takes place here.
(iv) The entire process takes place in the testes only.	(iv) The entire process is completed partly in ovary and in fallopian tube.
(v) No need of fertilization.	(v) It is necessary for the formation of matured ovum.
(vi) No polar bodies are formed.	(vi) Polar bodies are formed.

### **SECTION-D**

**Attempt any three of the following question:**

**[12]**

**Q.27 A homozygous Dwarf & Round seeded plant is crossed with homozygous Tall & Wrinkled seeded plant. State the phenotypic ratio in the  $F_2$  generation. Identify the cross, define it & state the law put forward by Mendel based on this cross. (4)**

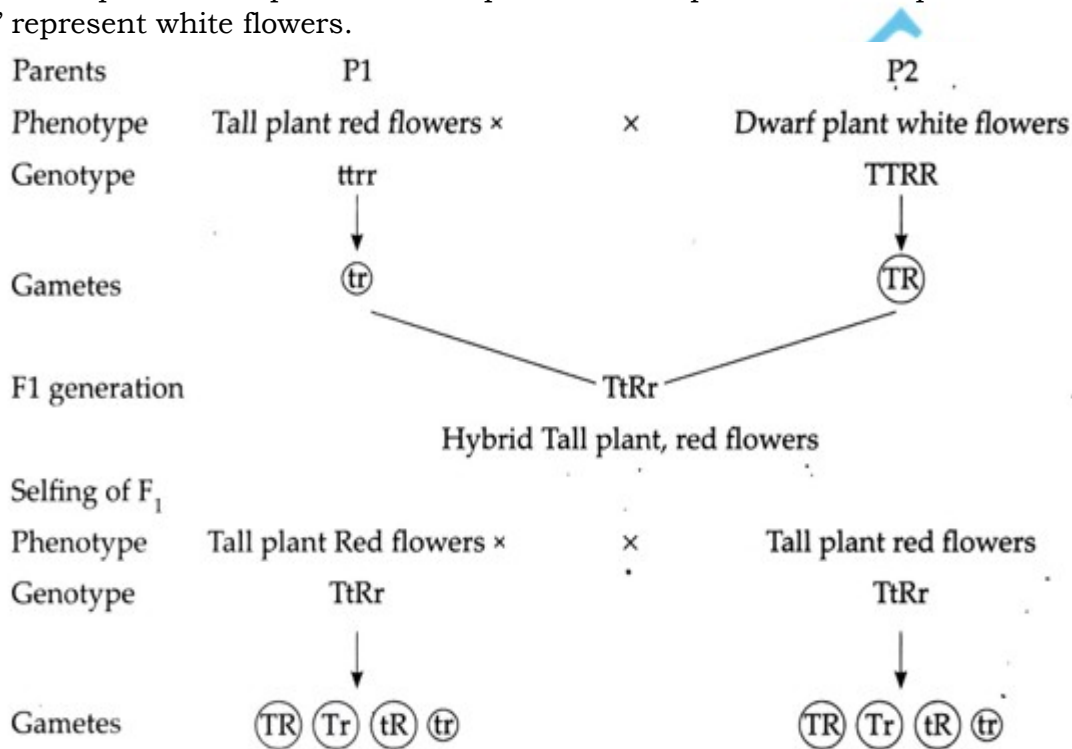
**Ans:**

**Statement of the Law**

“when a hybrid possessing two or more pairs of contrasting characters (factors/alleles) forms gametes, the factors in each pair segregate independently of the other pair.”

Consider a cross between a pure tall pea plant with red flowers and a pure dwarf pea plant with white flowers.

Let ‘T’ represent tall plants Let ‘t’ represent dwarf plants. Let ‘R’ represent red flowers. Let ‘r’ represent white flowers.



$F_2$

$\begin{matrix} \circ & \text{OG} \rightarrow \\ + & \text{G} \downarrow \end{matrix}$	(TR)	(Tr)	(tR)	(tr)
(TR)	TTRR Tall Round	TTRr Tall Round	TtRR Tall Round	TtRr Tall Round
(Tr)	TTRr Tall Round	TTrr Tall Wrinkled	TtRr Tall Round	Ttrr Tall Wrinkled
(tR)	TtRR Tall Round	TtRr Tall Round	ttRR Dwarf Round	ttRr Dwarf Round
(tr)	TtRr Tall Round	Ttrr Tall Wrinkled	ttRr Dwarf Round	ttrr Dwarf Wrinkled

**Phenotypic ratio**

9 : 3 : 3 : 1  
Tall : Tall : Dwarf : Dwarf



Round                  Wrinkled                  Round                  Wrinkled

**Genotypic ratio**

1 : 2 : 2 : 4 : 1 : 2 : 1 : 2 : 1

1 – TTRR

2 – TTRr

2 – TtRR

4 – TtRr

1 – TTrR

2 – Ttrr

1 – ttRR

2 – ttRr

1 – ttrr

**Q.28 Explain steps in parturition?**

**(4)**

**Ans:**

**Definition:** It is the act of expelling the full-term body form mother's uterus at the end of pregnancy period (gestation), completed in 280 days from Mothers' last menstruation.

1. Labour is the physical activities involved in childbirth like uterine and abdominal contractions, dilation of cervix and passage of baby. They cause vigorous contractions of myometrium of uterus at the end of pregnancy.
2. The fully developed foetus gives signals for the uterine contractions by secreting Adrenocorticoid Hormone (ACTH) from pituitary and corticosteroids from adrenal gland.
3. This triggers release of oxytocin from mother's pituitary gland This acts on uterine muscles of mother and causes vigorous uterine contractions. Thus, the baby is pushed out from the uterus.

The steps are as follows-

- a. **Dilation stage:** Uterine contractions begin from top, forcing the baby towards the cervix. Oxytocin induced uterine contractions become stronger and stronger due to stimulatory reflex. As the baby is pushed down in the uterus, its head comes to lie against cervix. Cervix gets dilated. The vagina also shows similar dilation. This stage of labour can normally last up to few hours. It ends in rupturing of amniotic membrane of foetus.
- b. **Expulsion stage:** The uterine and abdominal contraction become stronger. In normal delivery, the foetus passes out through cervix and vagina with head in Forward direction. It takes 20 to 60 min.
- c. **After birth:** After birth delivery of the baby the placenta separates from the uterus and is expelled out us "after birth", due to sever contractions of the uterus. This process happens within 10 to 45 min of delivery.

**Q.29 Explain the internal structure of human heart with the help of suitable diagram. (4)**

**Ans:**

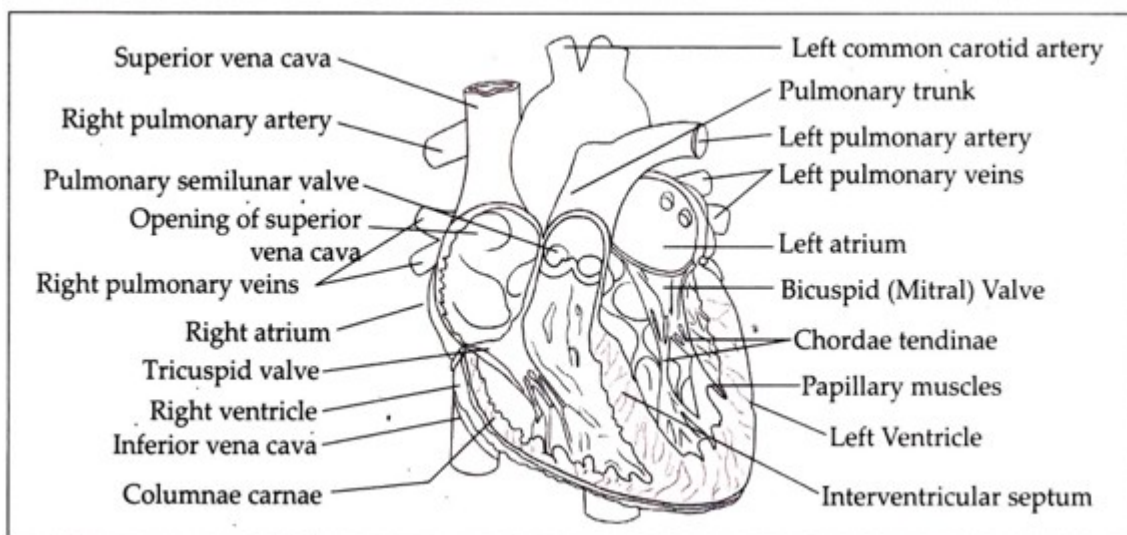
**1. Atria:**

- a. They are receiving chambers of heart.
- b. Separate from each other by inter auricular septum.
- c. Inter auricular septum has an oval depression called fossa ovalis. It is remnant of embryonic aperture called foramen ovalis
- d. Superior vena cava (precaval), inferior vena cava (post caval) and coronary sinus open into the right atrium.
- e. Opening of post caval is guarded by Eustachian valve, while Thebesian valve guards the opening of coronary sinus in to right atrium.

- f. Four pulmonary veins open into left atrium. These opening are without valves.
- g. Both atria open into ventricles to their respective sides by atrioventricular apertures, the openings are guarded by cuspid valves.
- h. Tricuspid valve is present in right AV aperture a bicuspid valve (mitral valve) is present in left AV aperture.
- i. All heart valves help in maintaining a unidirectional flow of blood. They avoid back flow of blood.

## 2. Ventricles:

- a. They are interior, thick-walled pumping chambers of the heart.
- b. Right and left ventricle are separated by an intraventricular septum.
- c. Wall of left ventricle is more muscular and about 3-time thicker than right ventricle.
- d. Inner surface of the ventricle has several rigids called columnar Carna or trabeculae carnae which divide the lumen of ventricle in to small pockets or fissures.
- e. The lumen of ventricles has inelastic fibres called chordae tendinea. These attach the bicuspid and tricuspid valves to the ventricular wall (papillary muscles) and regulate their opening and closing.
- f. Right ventricle opens into pulmonary aorta and left ventricles open into the aorta. Openings are guarded by three semilunar valves each.
- g. Valves prevent backward flow of blood into the ventricles.



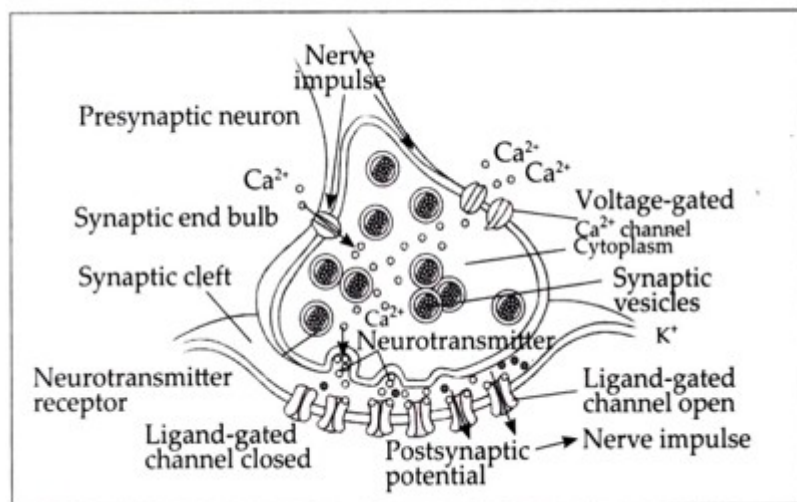
### Q.30 Explain how impulse is transmitted through a synapse

(4)

Ans:

1. A chemical synapse between a motor neuron and a muscle cell is called a neuromuscular junction.
2. Synaptic transmission of nerve impulse involves three components.
  - a) The presynaptic terminal (axonic terminal)
  - b) The post synaptic cell membrane (dendrites of the next neuron / gland cell/ muscle)
  - c) The post synaptic neuron.
3. The impulse travels along the axon of the pre-synaptic neuron to the axon terminal.
4. Axon terminals have several synaptic knobs.
5. These synaptic knobs possess membranous sacs, called synaptic vesicles.
6. Synaptic vesicles contain neurotransmitter molecules.
7. When an impulse reaches a synaptic knob, voltage sensitive  $Ca^{++}$  channels open which diffuse  $Ca^{++}$  ions inward from extra cellular fluid.
8. The increased  $Ca^{++}$  concentration initiates synaptic vesicle' to fuse with the cell membrane of presynaptic neuron.

9. After fusion, synaptic vesicle release their neurotransmitter by exocytosis process.
10. As soon as the neurotransmitters bind with receptors of the post – synaptic cell, the action takes place.
11. Depending upon the nature of transmitter involved, the action is either excitory or inhibitory.
12. Once the impulse has been transferred the neurotransmitters are destroyed by the enzyme cholinesterase.
13. Now, the synapse is ready to receive a new impulse.



**Q.31 Describe the replication of eukaryotic DNA with a suitable diagram. (4)**

**Ans:**

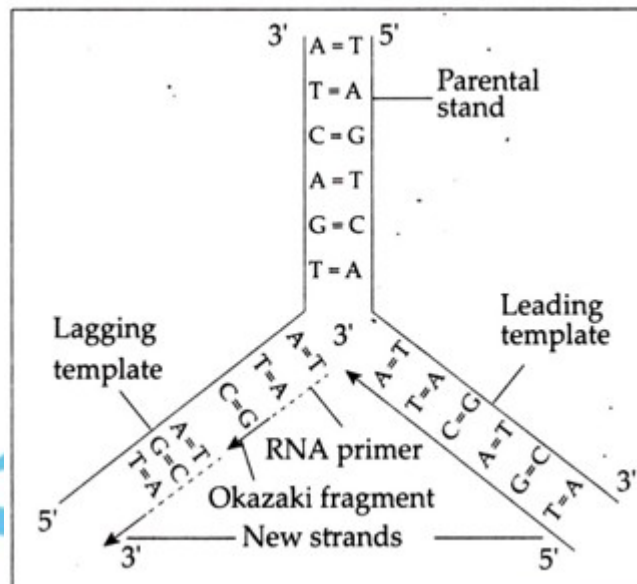
- 1) **Definition:** The most important property of DNA is that it can form exact copies of itself. This is called self-duplication or replication.
- 2) **Introduction:**
  - a. It takes place in the S – phase of cell cycle. Thus, the daughter cells formed after the cell division get equal number and identical chromosomes.
  - b. Thus, the process of biosynthesis by which DNA molecule is duplicated is called as replication. The base pairing in DNA is strictly complementary, each separated strand functions as a mould or template for the synthesis of its sister's strand.
  - c. The specific base pairing is A pairs with T and G pairs with C. The process of replication is completed in following steps-
- 3) **Point of origin:** Replication begins at a specific point called as point of origin. There are one to many points of origin.
- 4) **Unwinding or Unzipping:**
  - a. The helically coiled strand of DNA is made straight by the enzyme Topoisomerase (helix stabilizing protein)
  - b. The hydrogen bonds between two strands are broken due to the enzyme helicase (DNA unwinding protein or rep protein). The two separated strands are prevented from recoiling by single strand binding proteins (SSBP). Due to unwinding, the separated strands form a Y – shaped fork called replicating fork.
- 5) **Synthesis of new strands:**
  - a. The separated strand now acts as template or mould for the synthesis of new strands. The template strands have unpaired nitrogenous base along their length.



- b. The small RNA molecule called as RNA primer gets associated with the free end of the template strand and attracts complementary nucleotides from surrounding nucleoplasm.
- c. The attracted nucleotides on the old strand, following A=T and G=C pattern. The newly attracted nucleotides are joined to form continuous strand. The process is catalysed by the enzyme DNA polymerase.

6) **Leading and Lagging strands:**

- a. The process of replication always starts at C – 3 ends of the template strand and proceeds towards C – 5 ends. As the two strands of parental DNA are antiparallel, new strands are always formed in 5' 3' direction.
- b. Only one of the newly formed strands develops continuously towards the replicating fork end called as leading strand. Another new strand develops discontinuously away from the replicating fork end called lagging strand.
- c. The lagging strand develops in the form of small fragments called as Okazaki fragments (named after Japanese scientists Okazaki). The Okazaki fragments are linked by an enzyme DNA ligase.



7) **Semiconservative Method:**

In newly formed DNA molecule one strand is old (i.e., Conserved) and the other strand is newly synthesized. This is called semi-conservative nature of replication.



**“All the Best”**

“The best preparation for tomorrow is doing your best today.”