General Instructions:

1. Sections A: Q. No. 1 contains **10** multiple choice questions carrying **one mark** each
Q. No. 2 contains **8** very short answer type questions carrying **one mark** each
2. **Section B:** Q. No. 3 to Q. No. 14 are **12** short answer-I type questions **carrying two marks** each. Attempt any **eight** questions.
3. Section C: Q. No. 15 to Q. No. 26 are **12** short answer-II type questions carrying **three marks** each. Attempt any **eight** questions.
4. Section D: Q. No 27 to Q. No. 31 are **5** long answer type questions carrying **four mark** Attempt any **three** questions.

SECTION A

Q.1. Select and write correct answer: 10.

1 A) Primary endosperm nucleus
2 D) grey
3 B) Cryptorchidism
4 B) Hugo de varies
5 A) Gibberellin fujikuroi
6 B) sphygmomanometer
7 A) pituitary
8 B) 50
9 B) flaccidity
10 B) DNA $\xrightarrow{Transcription}$ mRNA $\xrightarrow{Translation}$ protein

Q.2 Answer the Following : 8.

1 Biotic and abiotic component are the components of ecosystem.
Biotic components : Living organisms in the ecosystem
Abiotic component : Soil, water, rock, minerals temperature.

2 Organic evolution is defined as a slow, gradual, continuous, irreversible change through which the present day complex forms have descended from their simple pre existing forms of the past.

3 Amniocentesis is a process in which amniotic fluid containing foetal cells is collected using a hollow needle inserted into the uterus ultrasound guidance.

4 Crossing over is a process that produces new combination (recombination) of genes by interchanging and exchanging of corresponding segments between non-sister chromatids of homologous chromosomes.

5 Immunoglobulins or antibodies glycoproteins which are highly specific to specific antigens.

6 IAA stands for indole -3-acetic acid. It is the most common and important natural auxin. IAA plays key role in bud growth and root formation.

7 Biofortification is a method in which crops are breed (produced) for having Higher level vitamins, Minerals and fats for better nutritive value.

8 1. Deficiency of antidiuretic hormone (ADH) reduces water re-absorption and increases urine output. This condition is called diabetes insipidus
2. No glucose is lost in the urine.
3. Excessive micturition causes excessive thirst. This condition is called polydipsia.

SECTION B

Attempt ant Eight : 16.

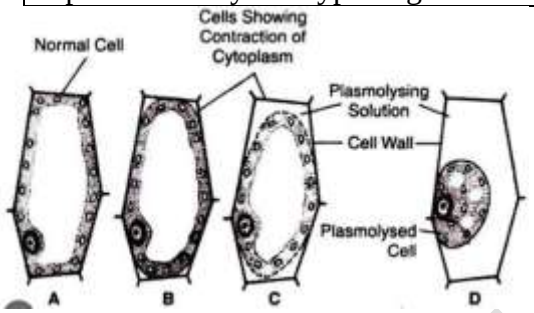
Q.3 1. This term is coined by Noll (1902). 2
2. It is the condition in which fruit is developed without the process of fertilization.
3. It occurs naturally in some varieties of Pineapple, Banana, Papaya, etc.
4. In these plants, it seems that the placental tissue in the unfertilized ovary produces auxin

IAA (Indole-3 Acetic Acid) which is responsible for enlargement of ovary into fruit.
5. The fruit resembles the normally produced fruit but it is seedless

Q.4

Homozygous	**Heterozyhous**
An individual possessing similar alleles for a particular trait is homozygous.	An individual possessing dissimilar alleles for a particular trait is called heterozygous.
It is called pure for the trait.	It is called hybrid for the trait
It breeds true to the trait	It does not breed true to the trait.
It produces only one type of gamete.	It produces different types of gametes.

Q.5 2



1. When a cell is placed in a highly concentrated solution (hypertonic solution) exosmosis results in shrinkage of protoplasm. Such a cell with shrunken protoplasm is called plasmolysis cell and this phenomenon is called plasmolysis.
2. When a plasmolysed cell is placed in water or hyprotonic solution. It reabsorbs water by endosmosis and its protoplast resumes its original shape and position. This phenomenon is called deplasmolysis.

Q.6 1. Any alternation in allele frequency in the natural population by chance is called as genetic drift.
2. The concept of genetic drift was first given by Sewall Wright hence, called as Sewall wright effect.
3. For example, elimination of a particular allele from a population due to events like accidental death prior to mating of an organism.
4. Genetic drifts are random or direction less.
5. The effect of genetic drift is more significant in small population than in large population.
6. Due to genetic drift, some alleles of a population are lost or reduced by chance and some others may be increased.

Q.7 1. The fluid secreted by the mammary glands soon after child birth is called colostrum.
2. It is sticky and is a yellow fluid which contains proteins, lactose and mother's antibodies e.g. IgA.
3. The fat content in colostrum is low.
4. The antibodies present in it helps in developing resistance for the new born baby at a time when its own immune response is not fully developed.

Q.8 The microorganisms used for the production of SCP are as follows:
1. **Fungi:** Aspergillus niger, Trichoderma viride
2. **Yeast:** Saccharomyces cerevisiae, Candida utilis
3. **Algae:** Spirulina spp, Chlorella pyrenoidosa
4. **Bacteria:** Methylophilus methylotrophus, Bacillus megasterium.

Q.9 1. Plant absorbs water, gases, mineral, nutrients, etc. from surroundings.
2. Green plants for the synthesis of their organic food need inorganic substances (elements)

which are obtained from soil in the form of minerals.
3. Minerals constitute most commonly occurring solid, inorganic materials obtained from the earth's crust.
4. Chemical analysis of plant ash clearly indicates that plant absorbs mineral elements from surroundings (soil, air and water) for its use.
5. About 36 to 40 different elements of periodic table are used as minerals by the plants. These are absorbed in ionic (dissolved) form as PO_4, CO_3,SO_4, etc., usually through roots (regions of elongation and growth)

Q.10. 1. Restriction enzymes serve as defence mechanism.
2. Bacteria protect its own DNA from nucleolytic attack by methylation the bases at susceptible sites, a chemical modification that blocks the action of the enzyme.
3. The restriction enzymes are thus the molecular scissors that are used to recognize and cut DNA at specific sequences. The sites recognized by them, are called recognition sequences or recognition sites.

Q.11. 1. In any ecosystem, the energy flows from producers who capture and convert it from the radiant solar energy to primary, secondary and tertiary consumers.
2. The energy captured by producers does not go back to the solar input or the energy which passes to consumers does not go back to producers.
3. As the energy flows progressively through various trophic levels, it is no longer available to the previous trophic level.
4. Hence, in the ecosystem the energy flow is unidirectional.

Q.12. The biodiversity can be protected by :
1. Natural preserves
2. Reducing invasive species
3. Habitat restoration
4. Captive breeding and seed banks
5. Research
6. Reduce climate changes
7. Purchase sustainable products

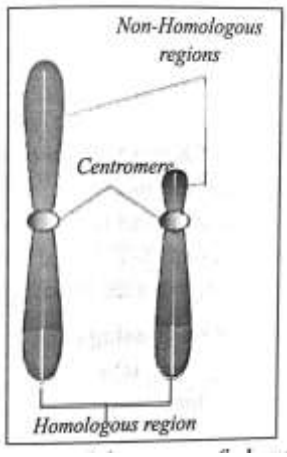
Q.13. Closed circulation is more efficient that open circulation because of the following reasons:
1. A high pressure of blood can be maintained so that the blood flows at a faster rate.
2. The fast rate of blood flow will ensure that the nutrients (food and oxygen) are supplied and wastes (nitrogenous and carbon dioxide) are removed faster as well.
3. The volume of blood reaching different organs can also be well regulated.

Q.14. 1. Limbic system is a complex neuronal circuit formed by the hypothalamus amygdala, parts of epithalamus and thalamus, hippocampus and other areas.
2. It appears to be responsible for emotional reactions, motivational drives and memory.

SECTION C

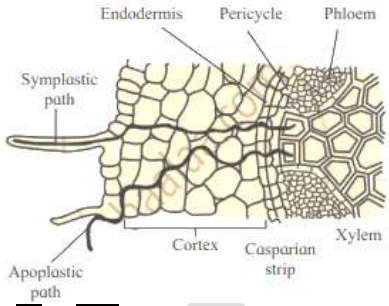
Attempt Any Eight 24.

Q.15. 1. X and Y chromosomes are the sex chromosomes.
2. X chromosome is straight, rod like and longer than Y chromosome.
3. X chromosome is metacentric, while Y chromosome is acrocentric.
4. X chromosome has large amount of euchromatin (extended region) and small amount of heterochromatin (highly condensed region), hence it is genetically active. Y chromosome has small amount of euchromatin and large amount of heterochromatin, hence it is genetically less active or inert.



5. Both X and Y chromosome show homologous and non-homologous regions.
6. X-linked genes are present on non-homologous region of X chromosome while Y linked genes are present on non-homologous region of Y chromosome

Q.16. 1. Water is absorbed by root hair cell through imbibition - diffusion - osmosis, sequentially.
2. Consequently the cell becomes turgid, its turgor pressure increases but its DPD value decreases.



3. However the immediately adjacent cortical cell inner to it, has more DPD value, because it's OP is more.
4. Therefore cortical cell will suck water from the at turgid root hair cell.
5. It then becomes turgid. The flaccid root hair cell now absorbs water from soil.
6. Water from turgid cortical cell is sucked by inner cortical cell, thus a gradient of situation pressure (DPD) is developed from cells of epiblema to the cortex of the root, followed by passage cells of endodermis and finally into the cell of pericycle and to protoxylem.
7. Absorption of water being a continuous process, a sort of hydrostatic pressure is developed in living cells of root. This is called as root pressure.
8. It is due to root pressure, water from pericycle is not only forced into the xylem, but also conducted upwards against the gravity.

Q.17. Pollination can be divided into three types on the basis of source of pollination.

1. Antogamy (self- pollination) - It is a type of pollination in which bisexual flower is pollinated by its own pollen grains. Offsprings are genetically identical to their parents e.g. pea.

2. Geitonogamy - It is the transfer of pollen grain to a stigma of a different flower produced on the same plant. It is functionally similar to cross pollination as it involves pollinating agents, but it cannot bring about genetic variations and is only hoou of ecological significance e.g. Cucurbita maxima. It is similar to antogamy as pollen grains come from same plant.

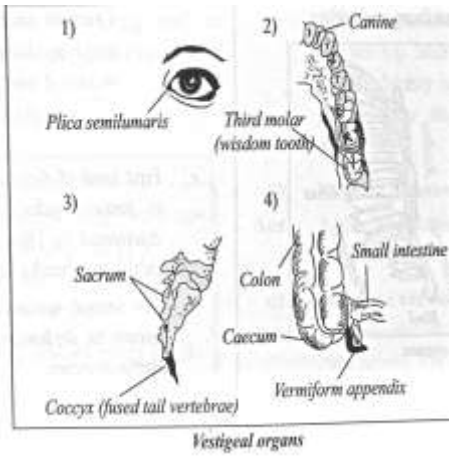
3. Xenogamy (cross pollination / outbreeding) - It is a type of cross pollination when pollen

grain of one flower is deposited on the stigma of a flower of different plant belonging to same species, with the help of pollinating agency. It generates genetically varied offsprings.

Q.18. 1. Air pollutants are of two types: Particulate pollutants and Gaseous pollutants.
2. Smoke, smog, pesticides, heavy metals, dust and radioactive elements are the examples of particulate pollutants whereas gaseous pollutants include CO_2, CO, SO_2,NO, NO_2, etc.
3. Particulate pollutants if inhaled deeply causes irritation, inflammation and damage to lungs. In addition to this, it causes breathing and respiratory disorders and premature deaths.
4. Gaseous pollutants such as CO_2 causes global warming, CO cause Carbon monoxide poisoning dizziness, NO_2 causes irritation to eyes, injury to lungs, liver, kidney, etc.

Q.19. **(a) Penis -**
i. Penis is the male copulatory organ.
ii. It is cylindrical and muscular with three bundles of erectile tissue- a pair of postero-lateral tissue called corpora cavernosa and a median corpus spongiousm.
iii. The swollen tip of the penis is called glans penis.
iv. It is covered by a loose fold of skin called foreskin or prepuce.
(b) Scrotum -
i. Scrotum is a loose pouch of pigmented skin lying behind the penis and is divided into a right and left scrotal sac by a septum of tunica dartos made of smooth muscle fibres.
ii. The foetal testes are guided into and retained in the scrotum by a short fibro muscular band called gubernaculum.
iii. The testes remain suspended in scrotum by a spermatic chord.
iv. Failure of testis to descend into scrotum is called cryptorchidism. The failure also results in the sterility.
v. The cremaster and dartos muscles of scrotum help in drawing testes close or away from the body.
vi. This helps in maintaining the temperature of the testis 2-3 °C lower than the normal body temperature, necessary for spermatogenesis.

Q.20. 1. Vestigeal organs are imperfectly developed and non-functional, degenerate structures which were functional in some related and other animals or in ancestors.
2. The vestigeal organs are no longer required by the organism but indicate the relationship with those organisms were these organs are fully developed.
3. Presence of these vestigeal organs provide evidence that man has (evolved) descended from simple primates.
Examples: Human beings show some vestigeal organs like –
(a) Presence of vestigeal nictitating membranes.
(b) Presence of wisdom teeth (third molars).
(c) Coccyx (tail bone): It is greatly reduced in man since the tail is of no use due to erect posture.
(d) Vermiform appendix and the caecum. It is functional in herbivorous mammals for digestion of cellulose. In man due to eating of cooked food it has lost its function.



Vestigeal organs

Q.21.

Inborn immunity	Acquired immunity
Inborn immunity or innate immunity is the inborn capacity of the body to resist the pathogen.	Acquired immunity is the capacity of the body during the life to resit the pathogen
It is also known as natural immunity	It is also known as adaptive immunity.
It is non- specific Immunity because it has all the defense elements and can defend any pathogen.	It is specific immunity because it is specific for each type of pathogen.
It does not depend on previous exposure to foreign substance.	It depends on previous Exposure to foreign substances.
Inborn immunity produces quick response in the body.	Acquired immunity required several day to become activated.
Inborn immunity consists of anatomical, physiological, phagocytic and inflammatory barriers to defend against pathogens.	Acquired immunity consists of two major group of celled lymphocytes and antigen presenting cells to depend against pathogen.
Inborn immunity is found in all animals.	Acquired immunity is found only in vertebrates.

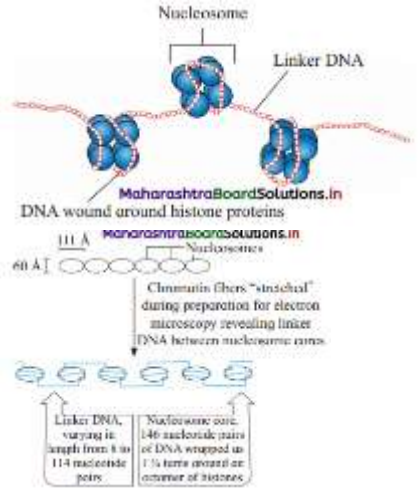
Q.22. 1. Fisheries provide rich protein diet for human beings.
2. Export of fishery products bring us valuable foreign currencies.
3. Fishes yield a number of byproducts such as fish oil, fish meal, fertilizer, fish guano, fish glue, isinglass, etc. which are of commercial value.
4. Culturing of fish in fresh water resources such as ponds, lakes and reservoirs boosts the productivity and economy of the nation.
5. Fishery provides good job opportunity and self-employment to many people.
6. Prawns and lobsters have market value all over the world.

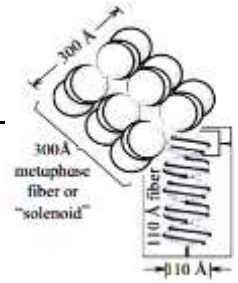
Q.23. 1. In eukaryotes, histones are required for the packaging of DNA.
2. Histones are the proteins that are rich in lysine and arginine residues which carry positive charge in their side chains.
3. These histones organise themselves to make a unit of 8 molecules known as histone octamer.
4. The negatively charged helical DNA is wrapped around the positively charged histone octamer, forming a structure known as nucleosome.
5. The nucleosome core is made up of two molecules of each of four types of histone proteins

viz. $H_2A, H_2B, H_3 and\ H_4$

6.H_1, protein binds the DNA thread where it enters (arrives) and leaves the nucleosome.

7. DNA helix of 200 bps wraps around the histone by $1\frac{3}{4}$ turns.





8. Six such nucleosomes get coiled and then form a solenoid, that looks like coiled telephone wire.

9. The chromatin is packed to form a solenoid structure of 30 nm diameter (300 A°) and further supercoiling tends to form a looped structure called chromatin fiber, which further coils and condense at metaphase stage to form the chromosomes.

Q.24 1. The heart is mesodermal in origin.

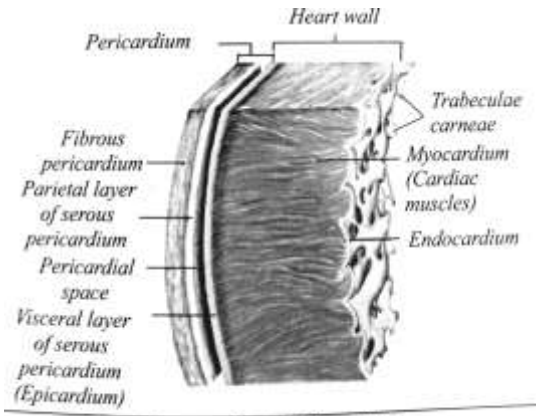
2. Its wall is formed of three layers, outer epicardium, middle myocardium and inner endocardium.

3. Epicardium is thin and formed of a single layer of flat squamous epithelium resting on basement membrane.

4. Myocardium is the middle thick layer formed of cardiac muscles.

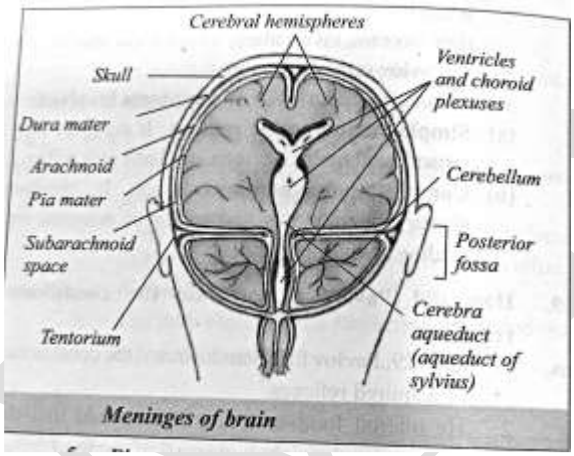
5. Endocardium is a single thin layer formed of squamous epithelium.

6. The epicardium and endocardium are protective in function whereas myocardium is responsible for contraction and relaxation of heart.



Heart wall and Pericardium

Q.25 1. The brain and spinal cord are the parts of CNS which lie along the mid dorsal axis.
2. Brain is enclosed within the brain box/cranium of the skull, whereas the spinal cord occupies the vertebral canal of the vertebral column. Inner to these bony coverings, are three protective membranes called meninges. That protects the brain and spinal cord.
3. Dura mater: It is the outermost tough, non- vascular, thick and fibrous meninx and is attached to the inner side of the cranium. It is separated from the underlying arachnoid mater by the subdural space, filled with a serous fluid.
4. Arachnoid mater: It is the middle, thin and non- vascular layer of connective tissue having web like appearance. It is separated from the pie mater below by a narrow subarachnoid space filled with cerebra spinal fluid - CSF.



Meninges of brain

5. Piamater: It is the innermost delicate, highly vascular membrane lies in close contact with the CNS.
6. The arachnoid mater and Dura mater are separated by subdural space filled with serous fluid.
7. In between the pie mater and arachnoid mater is subarachnoid space, containing lymph like watery fluid called cerebrospinal fluid. It is secreted by choroid plexus and ependymal cells.

Q.26 1. Basic physical characteristics of population are - its size and density.
2. Size speaks for the number of individuals in a population while density tells us number of individuals present per unit space, in a given time.
3. Besides size and density, the other characteristics include natality, mortality, immigration, Emigration, age pyramids, expanding population, population growth forms and biotic potential.
Natality:

1. It is the birth rate of a population. It has the greatest influence on a population's growth. Natality is a crude birth rate or specific birth rate.
2. Crude birth rate is used when calculating population size (number of births per 1000 population/year), whereas specific birth rate is used relative to a specific criterion such as age.
3. E.g. If in a pond, there were 200 carp fish last year and through reproduction 800 new fish are added, taking the current population to 1000, we calculate the birth rate as 800/200 4offspring per carp per year.
4. Absolute Natality: The number of births under ideal conditions (with no competition, abundance of resources such as food and water, etc.).
5. Realized Natality: The number of births when Environmental pressures come into play.
6. It must be remembered, that absolute natality will be always more than realized natality.

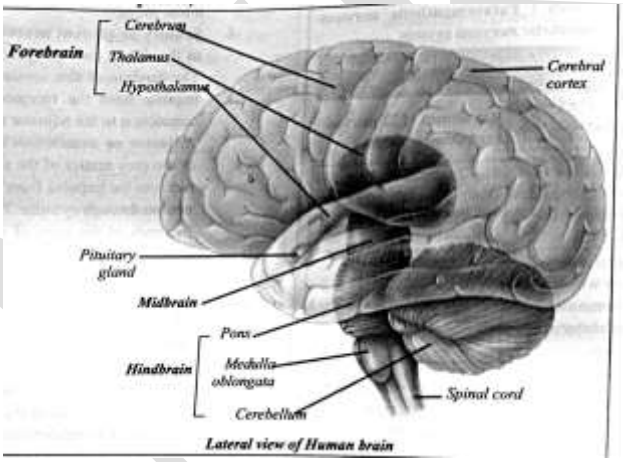
Mortality:

1. It is the death rate of a population. Mortality rate or death rate, is a measure of the number of deaths (in general, or due to a specific cause) in a particular population, in proportion to the size of that population, per unit of time.
2. Mortality rate is typically expressed in deaths per 1,000 individuals per year. Thus, a mortality rate of 9.5 (out of 1,000) in a population of 1,000 would mean 9.5 deaths per year in that entire population, or 0.95% out of the total.
3. Absolute Mortality: The number of deaths under ideal conditions (with no competition, abundance of resources such as food and water, etc.).
4. Realized Mortality: The number of deaths when environmental pressures come into play.
5. It must remembered that absolute mortality will be always less than realized mortality.

SECTION D

Attempt Any Three: 12

Q.27 Forebrain consists of olfactory lobes, cerebrum and diencephalon:



a. Olfactory lobes: These are highly reduced in human brain and covered by cerebrum from all sides except ventral. Each lobe consists of a olfactory peduncle and olfactory bulb.

b. Cerebrum :

1. It is a largest part of the brain, making up about 85% of total brain. It is divided into right and left cerebral hemisphere by means of a deep median, long fissure. The two hemispheres internally connected to each other by a thick band of nerve fibres called corpus callosum.
2. The outer surface of cerebrum is called cerebral cortex while the deep inner part is cerebral medulla. The cerebral cortex has outer thin region composed of grey matter and inner medulla composed of white matter.

3. The surface of each cerebral hemisphere is greatly folded by many convolutions or gyri and grooves called sulci. These greately increase total surface area for accomodation of the vast number of nerve cells.
4. Each cerebral hemisphere is further divided into four main lobes by three deep sulci. These are -
Centre sulcus which demarcates frontal lobe from the parietal lobe.
Parieto-occipital sulcus separates the parietal from occipital lobe.
The lateral or sylvian sulcus demarcates the temporal lobe from the frontal and parietal lobes

c.Diencephalon :

1. It is the part of the forebrain that contains the epithalamus, thalamus and hypothalamus.
2. It lies below the corpus callosum and above the midbrain. It encloses a single cavity termed third ventricle/Diocoelwhich communicates with the two lateral ventricles of cerebrum through a narrow opening called foramen of Monro.

Q.28. The human ovary is a compact structure consisting of inner medulla and outer cortex. The medulla contains connective tissue called stroma while the cortex is lined by germinal epithelium.

Histology of ovary:

1. Externally, ovary is covered by a single layer of cuboidal cells called germinal epithelium.
2. Inner to this is a tough, fibrous layer tunica albuginea, which is protective.
3. Inner to tunica albuginea is cortex. In the cortex are seen the follicles in various stages of development.
4. Follicle cells surrounding an ovum in a maturing follicle secrete oestrogen.

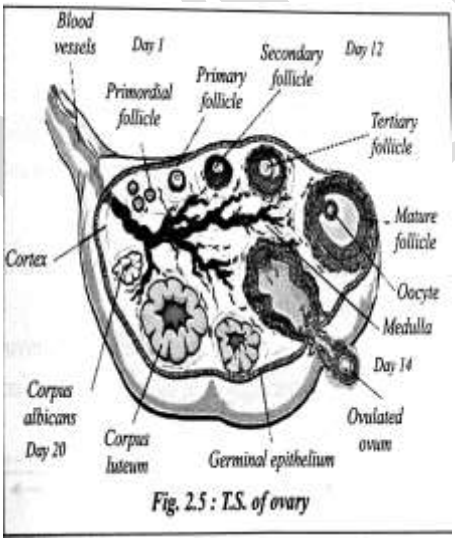


Fig. 2.5 : T.S. of ovary

Development of the primary follicle:

1. The development of the primary follicle starts with the secretion of the pituitary gonadotropic hormone called Follicle Stimulating Hormone (FSH).
2. Just inner to the follicle cells is a homogeneous layer called zona pellucida.

3. The primary follicle gradually goes on increasing in size. The ovum becomes excentric surrounded by the zona pellucida and corona radiata.
4. The primary follicle matures and develops into secondary follicle.

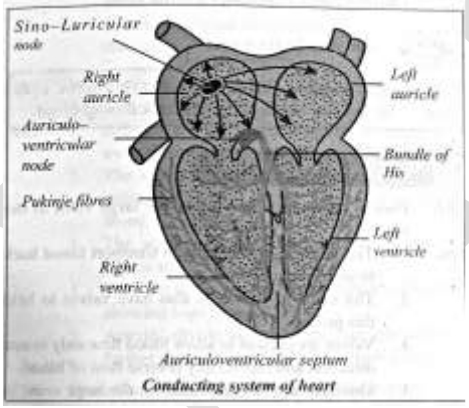
Development of secondary follicle :

1. A cavity develops surrounding the oocyte/ovum called antrum. This cavity gets filled with a fluid called liquor folliculi in which the oestrogen gets accumulated.
2. The cells of the follicle start dividing to form a layer of cells called membrana granulosa, which differentiates into two layers, outer called theca externa and the inner theca interna.
3. The size goes on increasing resulting in mature follicle called Graafian follicle.

Graafian follicle:

1. A mature Graafian follicle has a fully developed antral cavity surrounded by theca interna and theca externa.
2. As the Graafian follicle matures, oestrogen becomes maximum and the ovary is ready for ovulation.
3. Under the influence of pituitary hormone, luteinising hormone (LH), Graafian follicle ruptures and the oocyte is discharged to the outside.
4. Under the influence of LH, the empty Graafian follicle forms corpus luteum or yellow body that becomes endocrinal and secretes the hormone progesterone. This happens if fertilization takes place.
5. In the absence of fertilization, corpus luteum appears as a white body called corpus albicans that appears as a scar in the ovary called as corpus albicans.

Q.29. The conducting system of heart is made up of the myogenic heart which has the following conducting : SA node, AV node, Bundle of His and Purkinje fibres.



Conducting system of heart

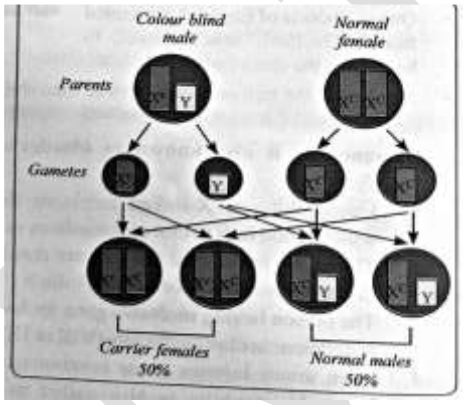
1. The heart beat originates in modified cardiac muscles called sinoatrial node which lies in the wall of the right atrium near the opening of the superior vena cava.
2. The sinoatrial node (SA node) is also known as the pacemaker, as it has the power of generation of a wave of contraction. This wave of contraction is conducted by the cardiac muscle fibres to both atria causing their contraction (atrial systole).
3. The atrioventricular node (AV node) is located in is the wall of the right atrium near the opening of the coronary sinus. The AV node receives the wave of contraction generated by the SA node through the internodal pathways.
4. Bundle of His arises from the AV node and divides into two branches, the right and left branch. These are located in the interventricular septum.

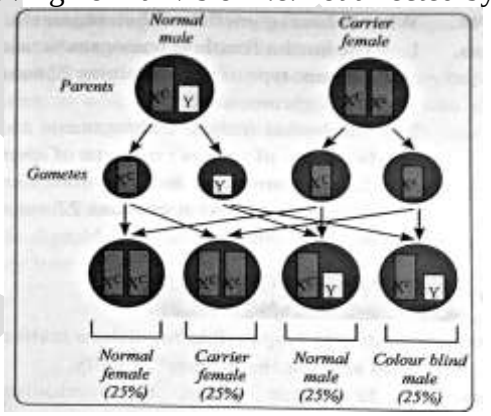
5. The bundle branches to give rise to Purkinje fibres which penetrate into the myocardium of ventricles.
6. The Bundle of His and Purkinje fibres together conduct the wave of contraction from the AV node to the myocardium of the ventricles causing their contraction (ventricular systole).

Q.30. 1. Colour blindness is a X-linked recessive disorder in which the person cannot distinguish between red and green colour as all appears grey.
2. It is caused due to recessive gene which prevents the proper formation of colour sensitive cells of retina necessary for distinction of red and green colour.
3. The genes for normal vision (dominant) and colour blindness (recessive) are located on non homologous region of X chromosome but their alleles are absent in Y chromosome.
4. If gene for normal vision is represented by X^C and gene for colour blindness X^C then the genotypes of the different individuals will be as follows:

Sex	Normal	Colour blind	Carrier
Male	X^CY	X^CY	–
Female	X^CX^C	X^CX^C	X^CX^C

a. If a colour blind male (X^CY) marries a female with normal vision (X^CX^C) then all the offsprings will have normal vision. However, daughters will be carriers for the disorder. In this cross, all the daughters have normal vision but are carriers for the disorder colour blindness. All the sons are normal having normal vision i.e. not affected by the disorder.





b. In another cross, if a carrier female (X^CX^C) marries the male with normal vision (X^CY) then all daughters will have normal vision of which 50% will be carrier for the disorder. Half the sons will be colour blind while the other half will be with normal vision. Thus, in this cross, one daughter is having normal vision while the other daughter is carrier for the disorder colour blindness. While one son is with normal vision while the other son is colour blind.
From the above examples, it is clear that colour blind father transmits the disorder to his grandson through his carrier daughter. The inheritance of the character from the father to his grandson through his daughter is called criss cross inheritance or skip generation inheritance.

Q.31. 1. The flowers must be pollinated in order to produce seeds and fruit. Seed development is initiated by fertilization. The integuments of the fertilized ovule persist and get transformed into the seed coat of mature seed.
2. Seed sometimes consists of two distinct coverings, a typical outer seed coat, the testa and

the inner thin, membranous tegmen. The nucellus in the ovule may persist in some genera like black pepper and beet as a thin, papery layer, the perisperm.
3. Seeds may be endospermic or non-endospermic. In endospermic seeds food reserves in the endosperm are partially used up in the development of an embryo. In non-endospermic seeds, food reserves are completely used up.
4. The cotyledons in some non-endospermic seeds act as a food storage and in others they are the first photosynthetic organs. Micropyle persists as a small pore in seed coat to allow the entry of water and oxygen during soaking. Fruit development is triggered by hormones produced by developing seeds. As mentioned earlier, after fertilization the zygote is formed and the ovary begins to differentiate into the fruit and ovary wall develops into pericarp.
5. Pericarp is basically three layered which get differentiated in the fleshy fruit like mango, coconut, etc.