



# Rao IIT Academy

## Symbol of Excellence and Perfection

JEE | MEDICAL-UG | BOARDS | KVPY | NTSE | OLYMPIADS

### XII HSC - BOARD - MARCH- 2018

Date: 06.03.2018

### BIOLOGY (J-282) - QP + SOLUTIONS

#### SECTION - I

**Q. 1** Select and write the most appropriate answer from the given alternatives (along with its alphabet number) for each sub-question : [7]

(i) The phenotypic ratio of incomplete dominance is \_\_\_\_\_.

- (A) 1 : 1                      (B) 3 : 1                      (C) 1 : 2 : 1                      (D) 9 : 3 : 3 : 1

Sol. (C)

*Topic: Genetic basis of inheritance ; Sub-topic: Incomplete dominance \_\_L-1\_\_ XII-HSC Board Test \_\_Biology*

(ii) Nucleoside is a nucleotide without \_\_\_\_\_.

- (A) Sugar                      (B) Nitrogen base                      (C) Hydrogen bond                      (D) Phosphate group

Sol. (D)

*Topic: Genes ; Sub-topic: DNA \_\_L-1\_\_ XII-HSC Board Test \_\_Biology*

(iii) Which of the following is white button mushroom?

- (A) *Agaricus bisporus*                      (B) *Pleurotus florida*  
(C) *Volvariella volvacea*                      (D) *Candida species*

Sol. (A)

*Topic: Microbes in human welfare ; Sub-topic: Mushroom \_\_L-1\_\_ XII-HSC Board Test \_\_Biology*

(iv) Brown rust of wheat is caused by \_\_\_\_\_.

- (A) viruses                      (B) bacteria                      (C) fungi                      (D) aphids

Sol. (C)

*Topic: Enhancement in food production ; Sub-topic: Disease \_\_L-2\_\_ XII-HSC Board Test \_\_Biology*

(v) The reaction centre of P.S. II is \_\_\_\_\_.

- (A) Chl-a, 700                      (B) Chl-a, 680                      (C) Chl-a, 673                      (D) Chl-a, 650

Sol. (B)

*Topic: Photosynthesis ; Sub-topic: Pigment system \_\_L-1\_\_ XII-HSC Board Test \_\_Biology*

(vi) The enzymes required for synthesis of ATP are located on

- (A) oxysomes                      (B) cristae                      (C) matrix                      (D) ribosomes

Sol. (A)

*Topic: Respiration ; Sub-topic:ETS \_\_L-1\_\_ XII-HSC Board Test \_\_Biology*

- (vii) In a food chain, the herbivores are represented by  
(A) producers (B) primary consumers  
(C) secondary consumers (D) decomposers

Sol. (B)

**Topic: Organism & Environment Part-1; Sub-topic: Foodchain \_\_ L-1 \_\_XII-HSC Board Test \_\_Biology**

**Q.2 (A) Sol.wer each question in 'one' sentense only : [6]**

- (i) What is leaching ?

Sol. Water soluble inorganic nutrients go down into the soil horizon and gets precipitated as unavailable salts is leaching.

**Topic: Organism & Environment Part-1; Sub-topic: Decomposition \_\_ L-1 \_\_XII-HSC Board Test \_\_Biology**

- (ii) Define chemoautotrophs.

Sol. Chemoautotrophs are those who make their own food by deriving the energy from chemical reactions. e.g., Nitrifying bacteria, Iron bacteria etc.

**Topic: Photosynthesis; Sub-topic: Autotrophic nutrition \_\_ L-2 \_\_XII-HSC Board Test \_\_Biology**

- (iii) Name the cell organelle in which Krebs' cycle occurs.

Sol. Kreb's cycle occurs in the matrix of mitochondira.

**Topic: Respiration; Sub-topic: Kreb's Cycle \_\_ L-1 \_\_XII-HSC Board Test \_\_Biology**

- (iv) What is 'deforestation' ?

Sol. Deforestation is the conversion of forested areas to non-forested ones.

**OR**

The permanent removal, decrease or deterioration of forests and woodlands chiefly by human activities is deforestation.

**Topic:Organism & Environment Part-1; Sub-topic:Deforestation \_\_ L-1 \_\_XII-HSC Board Test \_\_Biology**

- (v) Give the microbial source of Vit. B<sub>12</sub>.

Sol. *Pseudomonas denitrificans* is the microbial source of vit. B<sub>12</sub>.

**Topic: Microbes in human welfare; Sub-topic: Vitamin production \_\_ L-2 \_\_XII-HSC Board Test \_\_Biology**

- (vi) What is primary treatment of sewage ?

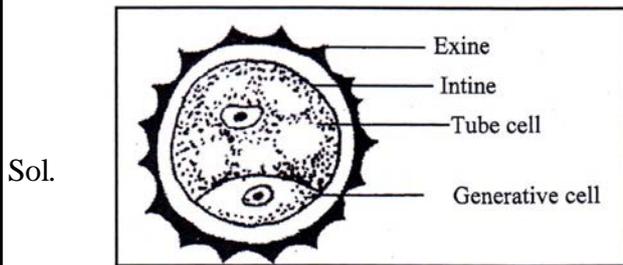
Sol. Filtration and sedimentation [Physical process] to remove floating debris and heavy particles respectively is primary treatment of sewage.

**Topic: Microbes in human welfare; Sub-topic: Sewage Treatment \_\_ L-1 \_\_XII-HSC Board Test \_\_Biology**

Q.2 (B)

Sketch and label a pollen grain of angiosperms.

[2]



Each labelling = 1/2 mark

**Topic: Reproduction in plant ; Sub-topic: Pollen grains \_\_ L-1 \_\_ XII-HSC Board Test \_\_ Biology**

Q.2 (C) Attempt any TWO of the following :

[4]

(i) Enlist the basic steps involved in recombinant DNA technology.

- Sol.
- Isolating genomic DNA of a 'donor'. The cell or organism from which the required gene is taken is called 'donor'.
  - Fragmenting this DNA using "molecular scissors" (Restriction endonuclease Enzymes).
  - Screening the fragments for a 'desired gene'.
  - Inserting the fragments with desired gene into a 'cloning vector'. (a plasmid, cosmid, or phage DNA) so as to develop a recombinant DNA or chimeric DNA.
  - Introducing the recombinant vector into a competent host cell.
  - Culturing these cells to obtain multiple copies or clones of desired fragment of DNA.
  - Using these copies to "Transform" suitable host cells so as to express the desired gene.

**Topic: Biotechnology ; Sub-topic: Recombinant DNA technology \_\_ L-2 \_\_ XII-HSC Board Test \_\_ Biology**

(ii) Give 'two' examples of microbial pesticides with their hosts.

Sol. **Pathogen** **Host range****Bacteria :**

- |  |  |
|--|--|
| (a) <i>Bacillus thuringiensis</i> (Bt) | Caterpillars (larvae of moths and butterflies),<br>larvae of Aedes, black flies, some adult beetles, wax moths, etc. |
|--|--|

**Fungi :**

- |                               |   |
|-------------------------------|---|
| (a) <i>Beauveria bassiana</i> | Aphids, mealy bugs,<br>mites, white flies, etc. |
|-------------------------------|---|

**Protozoans :**

- |                        |   |
|------------------------|---|
| <i>Nosema locustae</i> | Grasshoppers, caterpillars, some corn-borers and crickets |
|------------------------|---|

**Viruses :**

- |  |                              |
|--|------------------------------|
| (a) Nucleopolyhedrovirus or NPV<br>(125 types known) | Gypsy moths and caterpillars |
|--|------------------------------|

**Any Two to be written****Topic: Microbes in human welfare ; Sub-topic: Microbes as biocontrol agent \_\_ L-2 \_\_ XII-HSC Board Test \_\_ Biology**

(iii) Give the significance of respiration.

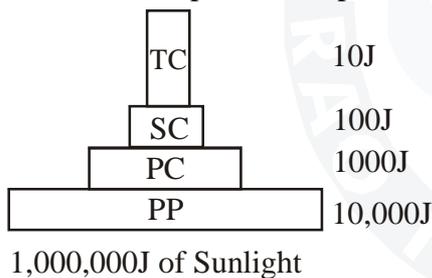
- Sol. (a) Respiration provides energy for biosynthesis of cellular materials such as carbohydrates, proteins, fats, lipids, vitamins, pigments, etc.  
 (b) It is also a source of energy for cell division, growth, repairs and replacement of worn out parts, movements, locomotion etc.  
 (c) Various intermediates of Krebs cycle are used as building blocks for synthesis of other complex compounds.  
 (d) Coupled with photosynthesis, it helps to maintain the balance between CO<sub>2</sub> and O<sub>2</sub> in the atmosphere.  
 (e) Anaerobic respiration (fermentation) is used in various industries such as dairies, bakeries, distilleries, leather industries, paper industries, etc. It is used in the commercial production of alcohol, organic acids, vitamins, antibiotics etc.  
 (f) Energy of respiration is also used to convert insoluble substances into soluble form.

**Any Four points to be written**

**Topic: Respiration ; Sub-topic: Significance \_\_ L-2 \_\_XII-HSC Board Test \_\_Biology**

(iv) Explain energy pyramid.

- Sol. Pyramid of energy is always upright, it can never be inverted. When energy flows from a particular trophic level to the next, some energy is lost as heat at every step. There is unidirectional flow of energy. The energy captured by autotrophs does not go back to the solar input or the energy which passes to herbivores does not go back to autotrophs. As the energy flows progressively through various trophic levels it is no longer available to the previous trophic level. [1 Mark]



[1 Mark]

**Pyramid of energy**

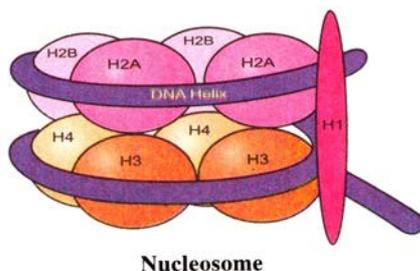
**Topic: Organism & Environment Part-1 ; Sub-topic: Pyramids \_\_ L-2 \_\_XII-HSC Board Test \_\_Biology**

**Q.3 (A) Attempt any TWO of the following :**

[6]

(i) With the help of a suitable diagram describe the structure of a nucleosome.

- Sol. The nucleosomes in chromatin are seen as 'beads-on-string'. Histones are proteins that are rich in the basic amino acid residues like lysines and arginines which carry positive charge in their side chains. Eight molecules of histones (two each of H2A, H2B, H3 and H4) get organized to form histone octamer. DNA is negatively charged and it is wrapped around the positively charged histone octamer to form nucleosome. Around the octamer DNA molecule is wrapped as 1 and 3/4<sup>th</sup> turn. The DNA is called core DNA (146 bp) and small segments of DNA linking octamer are called linker DNA (54 bp). Each nucleosome contains 200 bp of DNA helix. [2 Mark]



[1 Mark]

**Topic: Genes ; Sub-topic: Packing of DNA \_\_ L-2 \_\_XII-HSC Board Test \_\_Biology**

(ii) Describe the step of PCR technique.

Sol. The three essential steps of PCR technique are -

- (a) **Heat denaturation** : This step involves heating of DNA at about 91°C. The heating breaks the hydrogen bonds to make ssDNA. The DNA molecule with more G-C pairs, need higher temperature. [1 Mark]
- (b) **Annealing** : It is pairing of primers to the ssDNA segment. The primers have to be designed as per the requirement. This step requires temperature at about 55°C. [1 Mark]
- (c) **Polymerisation** : The temperature is raised to 72°C. The Taq polymerase adds dNTPs behind the primer on the ssDNA. These three steps constitute one cycle of the reaction (3-5 mins). The process is carried out for about 28-30 cycles beyond which its reliability decreases. [1 Mark]

*Topic: Biotechnology; Sub-topic: PCR\_\_ L-2\_\_XII-HSC Board Test\_\_Biology*

(iii) Describe different steps involved in tissue culture technique.

- Sol.
- (a) **Explant culture** : Proper explant is excised from the plant which may be a cell, tissue or a piece of plant organ. Generally parenchyma tissue or meristem is used as explants. The cells from explant absorb nutrients and start multiplying to form callus. Callus is unorganised mass of cells. [1 Mark]
  - (b) **Sterilization** : In tissue culture technique, different apparatus, medium used and the explant also is to be properly sterilized to avoid the contamination due to which the experiment may fail. The methods used for sterilization may be dry or wet sterilization, Alcohol sterilization etc. The explants used can be sterilized by using 1% sodium hypochloride or 70% ethyl alcohol or 10% hydrogen peroxide. [1 Mark]
  - (c) **Organogenesis** : Now the growth hormones like auxins and cytokinins in proper proportion are provided to the callus to induce formation of organs. If auxins are more, roots are formed (rhizogenesis) and if the cytokinins are in more quantity then the shoot system begins to develop (caulogenesis). [1 Mark]

*Topic: Enhancement in food production ; Sub-topic: Tissue culture \_\_L-1\_\_XII-HSC Board Test\_\_Biology*

**Q.3 (B)**

(i) Sketch and label T. S. of a leaf showing Kranz anatomy. [3]

Sol.

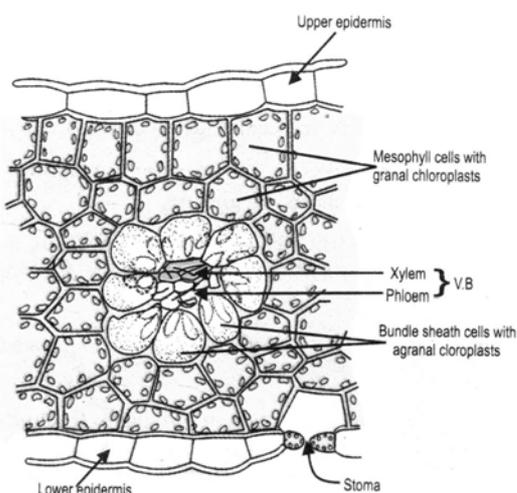


Fig 6.12 T.S. of leaf showing Kranz anatomy

Diagram 1 Mark & Labelling 2 Marks.

*Topic: Photosynthesis; Sub-topic: C4 pathway\_\_ L-2\_\_XII-HSC Board Test\_\_Biology*

Q.4

With the help of a neat and labelled diagram describe the development of female gametophyte of angiosperms. [7]

Sol. A diploid hypodermal cell at the micropylar end of nucellus gets differentiated to form archesporium. Mostly this single-celled archesporium directly functions as megaspore mother cell (MMC). This diploid MMC ( $2n$ ) undergoes meiosis to form a tetrad of haploid megaspores ( $n$ ). [1 Mark]

This process is known as megasporogenesis. Megaspores are generally arranged in linear tetrad. Generally the chalazal megaspore remains functional while three degenerate gradually. Functional (fertile) megaspore is the first cell of female gametophyte. It undergoes enlargement and develops into a female gametophyte. The haploid nucleus of functional megaspore undergoes three successive free-nuclear mitotic divisions. [1 Mark]

First mitotic division results in formation of two nuclei. Both the nuclei undergo two successive divisions. this results in formation of four nuclei at each pole and an 8-nucleated structure is formed. One nucleus from each pole comes to the center and they function as polar nuclei. [1 Mark]

This is followed by cellular organization to form 3-celled egg apparatus at micropylar end, three antipodals at chalazal end and two polar nuclei remain in the centre. Thus, 8-nucleated, 7-celled female gametophyte is formed withing the functional megaspore; therefore the development is called endosporic. Only one megaspore takes part in the formation of embryo sac; therefore it is called monosporic. (In some Angiosperms, embryo sac may be bisporic or tetrasporic). [1 Mark]

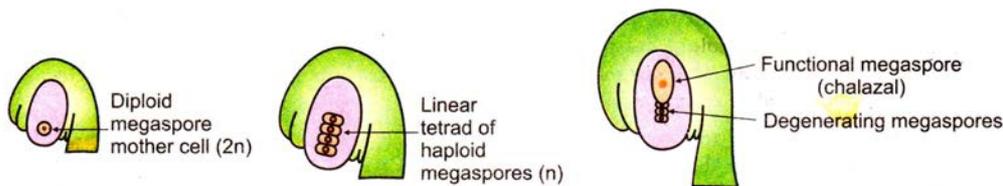
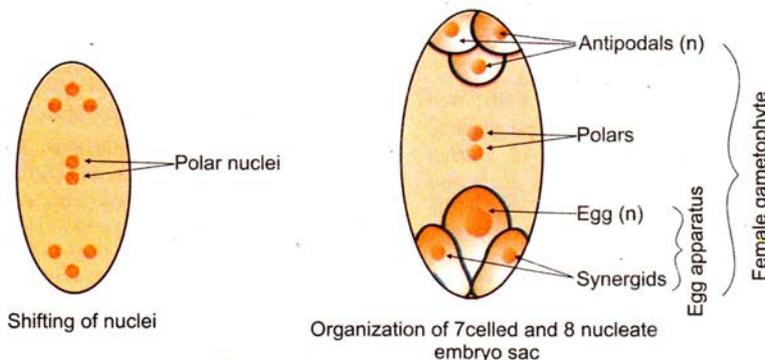
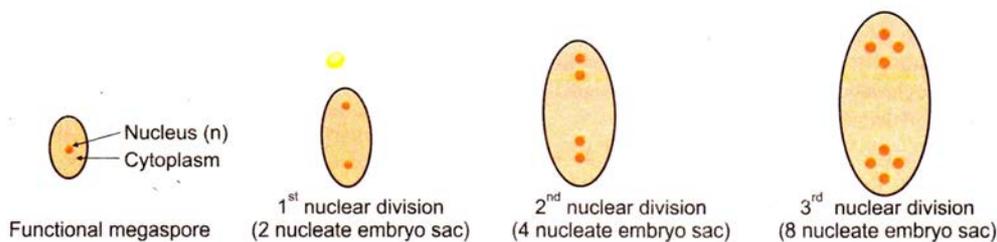


Fig.8.11(a) Megasporogenesis (diagrammatic)



Development of female gametophyte or embryo sac (Diagrammatic)

[3 Marks]

Topic: Reproduction and plants ; Sub-topic: Development of female gametophyte \_\_L-2\_\_ XII-HSC Board Test Biology

(OR)

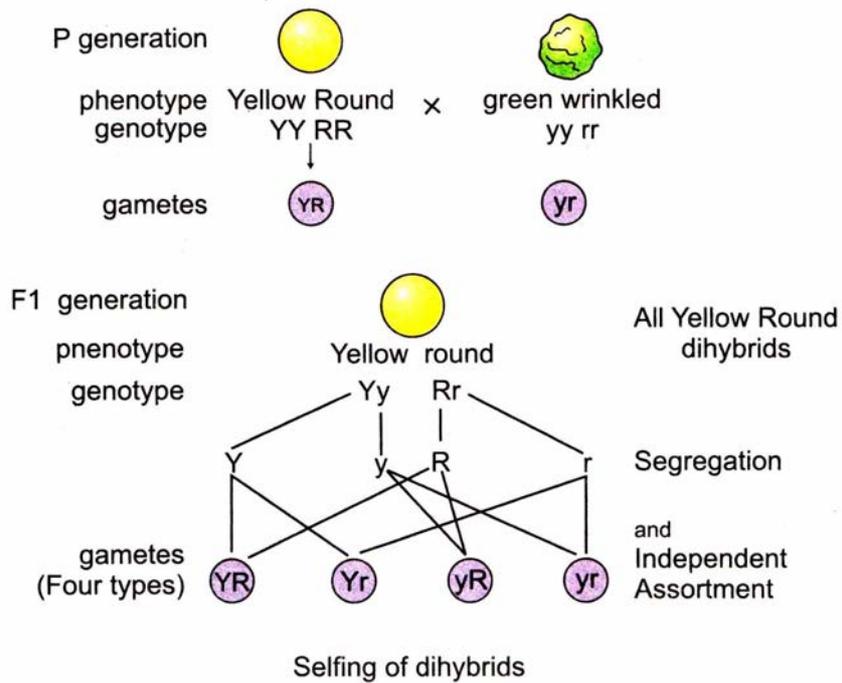
Explain “the law of independent assortment” with a suitable example. [7]

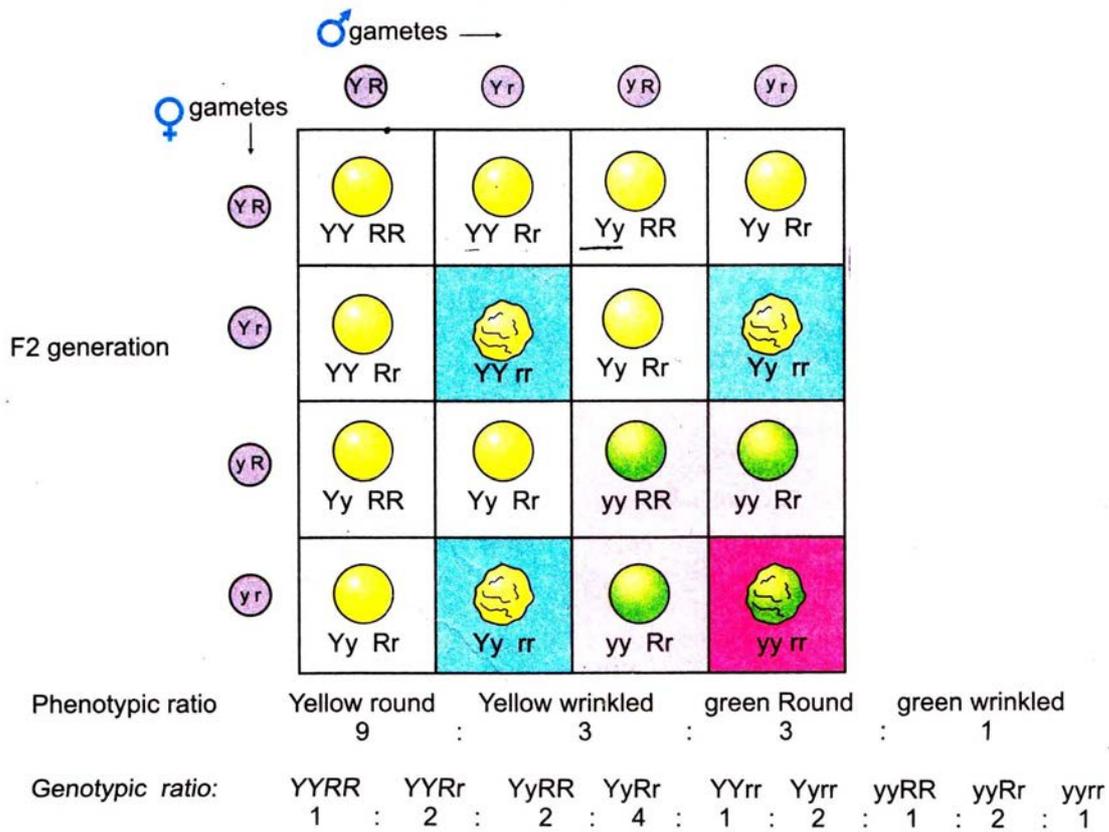
Sol. When the two homozygous parents differing in two pairs of contrasting traits are crossed, the inheritance of one pair is independent of the other. In other words, when a dihybrid (or polyhybrid) form gametes, assortment (distribution) of alleles of different traits is independent of their original combinations in the parents.

This law of independent assortment can be explained with the help of dihybrid cross and dihybrid ratio.

*Appearance of new combinations in F<sub>2</sub> generation proves the law.* [2 Marks]

Carry out dihybrid cross for any two characters till F<sub>2</sub> generation with phenotypic and genotypic ratio. [4 Marks]





Graphic representation of a dihybrid cross.

**Explanation :**

A gamete that receives 'Y' for colour may receive 'R' for shape or 'r' for shape. This would result in the formation of YR and Yr types of gametes. Similarly, a gamete that receives 'y' for colour may receive 'R' or 'r' for shape. This would result in formation of yR and yr types of gametes (Independent assortment).

[1 Mark]

*Topic: Genetics basis of inheritance ; Sub-topic: Law of independent assortment L-2 XII-HSC Board Test Biology*

**SECTION – II**  
**[ZOOLOGY]**

**Q. 5** Select and write the most appropriate answer from the given alternatives (along with its alphabet number) for each sub-question : [7]

- (i) \_\_\_\_\_ is used for desalination of brackish water.  
(A) Reverse osmosis    (B) Ion – exchange    (C) Adsorption    (D) Electrodialysis

Sol. (A)  
Reverse osmosis

*Topic : \_Organism & Environment - II\_ Sub topics : Water Pollution\_L-1\_XII-HSC Board Test\_\_Biology*

- (ii) Which of the following is mesodermal in origin?  
(A) Retina    (B) Enamel of teeth    (C) Heart    (D) Liver

Sol. (C)  
Heart

*Topic : Human Reproduction\_ Sub topics : Fate of Germinal layers\_L-2\_XII-HSC Board Test\_\_Biology*

- (iii) \_\_\_\_\_ is an exotic breed of cow.

- (A) Gir  
(B) Sindhi  
(C) Sahiwal  
(D) Jersey

Sol. (D)  
Jersey

*Topic : \_Animal Husbandary\_ Sub topics : Dairy\_L-1\_XII-HSC Board Test\_\_Biology*

- (iv) \_\_\_\_\_ maintains basic metabolic rate.

- (A) Thyroxine  
(B) ADH  
(C) GH  
(D) Oxytocin

Sol. (A)  
Thyroxine

*Topic : \_Control & Coordination\_ Sub topics : Endocrine Glands & their Hormones\_L-1\_XII-HSC Board Test\_\_Biology*

- (v) Which of the following is an example of ZW – ZZ type of mechanism of sex determination?

- (A) Honeybee  
(B) Fish  
(C) Bird  
(D) Human being

Sol. (C)  
Bird

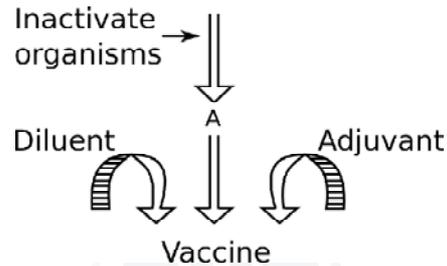
*Topic : Chromosomal Basis of Inheritance\_ Sub topics : \_Sex determination\_L-2\_XII-HSC Board Test\_\_Biology*

- (vi) Transfer of gene between population that differ genetically from one another is called \_\_\_\_\_.  
 (A) Gene mutation  
 (B) Gene flow  
 (C) Genetic drift  
 (D) Genetic recombination

Sol. (B)  
 Gene flow

**Topic : Origin of Life & Evolution\_ Sub topics : Modern synthetic theory of Evolution\_L-1\_XII-HSC Board\_\_Biology**

- (vii) In the given diagram of vaccine manufacturing process 'A' is \_\_\_\_\_.



- (A) Antigen                      (B) Antibody                      (C) Antitoxin                      (D) Antibiotics

Sol. (A)  
 Antigen

**Topic : Genetic Engineering & Genomics\_ Sub topics : Vaccine Production\_L-1\_XII-HSC Board\_\_Biology**

**Q. 6 (A) Answer the following questions in only 'one' sentence each :**

- (i) Longer toes and long prehensile tail indicate which adaptation?

Sol. Longer toes and long prehensile tail indicates arboreal adaptation.

**Topic : Origin of Life & Evolution\_ Sub topics : Origin & Evolution of Human Being\_L-2\_XII-HSC Board \_\_Biology**

- (ii) What does 'IUCD' indicate?

Sol. IUCD – means intra uterine contraceptive device. This a barrier / mechanical contraceptive method. e.g. CuT (Copper T), LNG – 20 etc.

**Topic : Human Reproduction\_ Sub topics : Reproductive Health\_L-1\_XII-HSC Board \_\_Biology**

- (iii) Name of valve between left atrium and left ventricle and give its significance.

Sol. Bicuspid or mitral valve is present between left atrium and left ventricle. It prevents the backflow of blood from ventricles to auricle or atrium.

**Topic : Circulation\_ Sub topics : Internal Structure of Human Heart\_L-1\_XII-HSC Board \_\_Biology**

- (iv) Give the use of bovine growth hormone.

Sol. Bovine growth hormone increases milk production.

**Topic : Genetic Engineering & Genomics\_ Sub topics : Transgenic Animals\_L-2\_XII-HSC Board**

(v) State any 'two' symptoms of Down's syndrome.

Sol. Symptoms of Down syndrome are as follows :

- (1) Most children shown typical facial features with a fold of skin (epicanthal skin fold) over the inner corner of the eye. This results in downward slanting of eyelids.
- (2) The face is typically flat and rounded flat nose, mouth open and tongue protruding.
- (3) Mental retardation.
- (4) Due to poor skeletal development, they have short stature and relatively small skull, palate is arched.
- (5) Flat hand with characteristic crease which runs all the way across the palm (simian crease).

**Topic : Chromosomal Basis of Inheritance\_ Sub topics : Chromosomal Disorder\_L-1\_XII-HSC Board Biology**

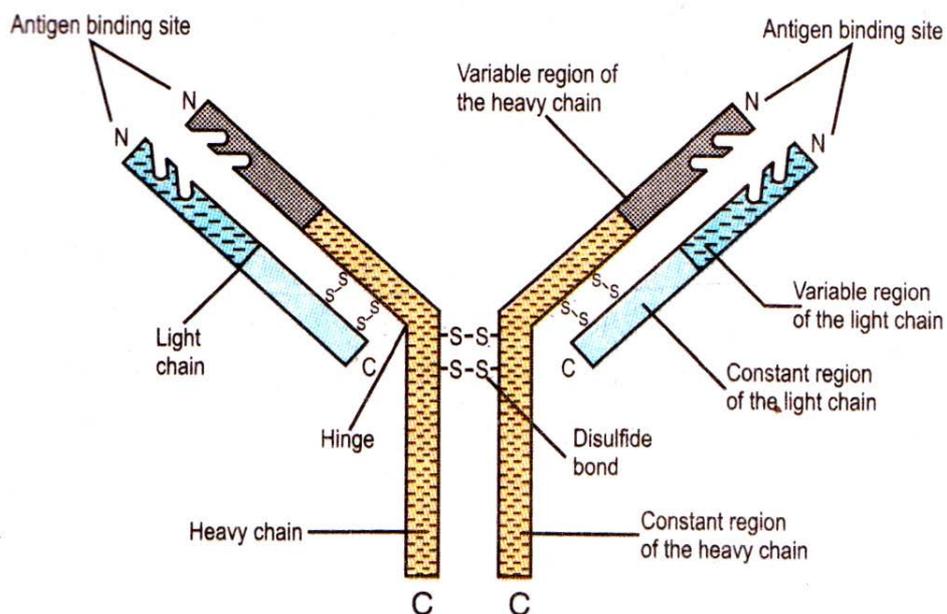
(vi) Mention any 'one' skeletal difference between ape and man.

Sol. Apes have prognathus face, while man have orthognathus face. Apes are semi-erect and quadripedal while man is Bipedal with erect posture.

**Topic : Origin of Life & Evolution\_ Sub topics : Origin & Evolution of Human Being\_L-2\_XII-HSC Board Biology**

(B) Sketch and label structure of Antibody.

[2]



**Structure of Antibody**

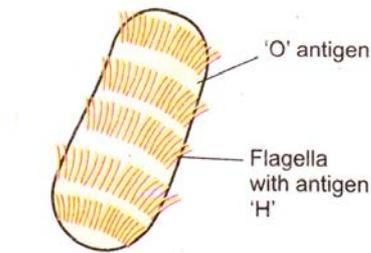
**Topic : Human Health & Diseases\_ Sub topics :Structure of Antibody\_L-1\_XII-HSC Board Biology**

(C) Attempt any TWO of the following :

[4]

(i) Name the causative organism of 'typhoid' and draw its diagram.

Sol. The causative organism for typhoid is *Salmonella typhi*.



Structure of *Salmonella typhi*

Topic : *Human Health & Diseases* Sub topics : *Typhoid L-1 XII-HSC Board Biology*

(ii) State the economic importance of 'lac culture'

Sol. Production of lac plays vital role in the economy of farmers. It is used in bangles, toys, wood work, polish, inks, silvering mirrors.

Topic : *Animal Husbandary* Sub topics : *Lac culture L-1 XII-HSC Board Biology*

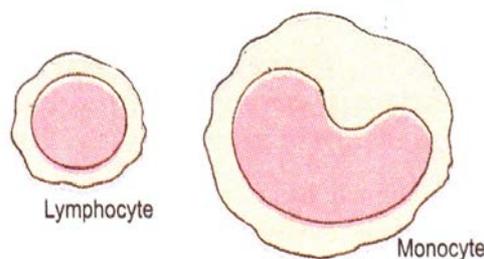
(iii) 'All organisms produce more young ones'. Comment.

Sol. Every living organisms has a great potential for reproduction. All organisms produced more young ones than those which can survive upto maturity. In other words, any population tends to increase in geometrical proportion. The sole purpose of organisms is to survive and perpetuate the species.

Topic : *Origin of Life & Evolution* Sub topics : *Darwin's theory of Origin of Species L-1 XII-HSC Board Biology*

(iv) Describe 'agranulocytes' with the help of diagrams.

Ans



### Agranulocytes

Agranulocytes show absence of granules in the cytoplasm and the nucleus is not lobed. They are of two types viz.

- i) Lymphocytes – They show round nucleus, constitute about 25 – 33 % of total WBC and are responsible for immune response of the body.
- ii) Monocytes – They show large kidney shaped nucleus, constitute about 3 – 9% of total WBC and are phagocytic in function.

Topic : *Circulation* Sub topics : *Blood Cells L-1 XII-HSC Board Biology*

**Q. 7 (A) Attempt any TWO of the following :** [6]

(i) Define parasitism and give any 'two' types with suitable example of each.

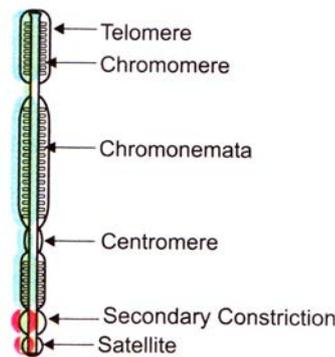
**Sol.** Parasitism is a type of symbiotic relationship between organism of different species where one organism, the parasite, benefits at the expense of other, the host.

Parasites are classified on the basis of their interaction with the host and on their life cycle as ectoparasites [those which live on the surface of the host ] e.g. Ticks and endoparasite [those which live inside the host] e.g. Tapeworm.

**Topic : Organisms & Environment- II Sub topics : Parasitism L-3\_XII-HSC Board \_\_Biology**

(ii) Describe the structure of chromosomes with a suitable diagram.

**Sol.** Chromosomes are filamentous bodies present in the nucleus and are visible during cell division. A metaphasic chromosome has 2 identical halves called sister chromatids. Each chromatid is in turn made up of sub-chromatids called chromonemata (singular – chromonema). The chromatids lie side by side and are held together at one point called the centromere. The centromere is also called the primary constriction. During cell division the spindle fibres are attached at the centromere. Besides the primary constriction, additional narrow areas called secondary constrictions are present. Some of the secondary constrictions are called nucleolar organizers because they are necessary for formation of nucleolus. The part of the chromosome beyond the nucleolar organizer is short, spherical and is called satellite. The tip of the chromosome is called telomere. It has a unique property in that it prevents the ends of the chromosomes from sticking together but attaches to the nuclear envelope. The surface of a chromosome bears number of small swellings called chromomeres.



**Structure of Chromosome**

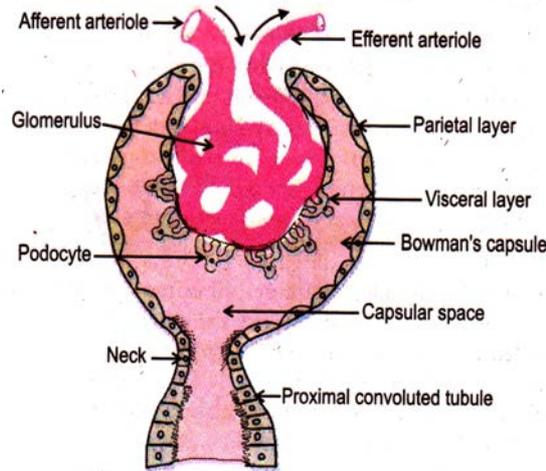
**Topic : Chromosomal Basis of Inheritance Sub topics : Structure of Chromosome L-1\_XII-HSC Board \_\_Biology**

(iii) Define 'genomics'. Give any 'two' applications of it.

**Sol.** Genomics is the study of molecular organization of genome. Human genome project (HGP) is aimed to produce map of human genome. These maps help in understanding location of genes, functions, distance between different genes and nucleotide sequence of each gene. HGP reveals that 99.9 % of genes are same in all individuals and only 0.001% difference is seen in DNA. Biotechnological applications for human health – Insulin is a hormone which regulates blood glucose level. In *Diabetes mellitus* patients, due to hyposecretion of insulin by pancreas, blood sugar level increases. Insulin is produced by using biotechnological methods. Vaccines are antigenic preparation which stimulate production of antibodies and induce immunity against several diseases.

**Topic : Genetic Engineering & Genomics Sub topics : Genomics & Human Genome Project L-2\_XII-HSC Board \_\_Biology**

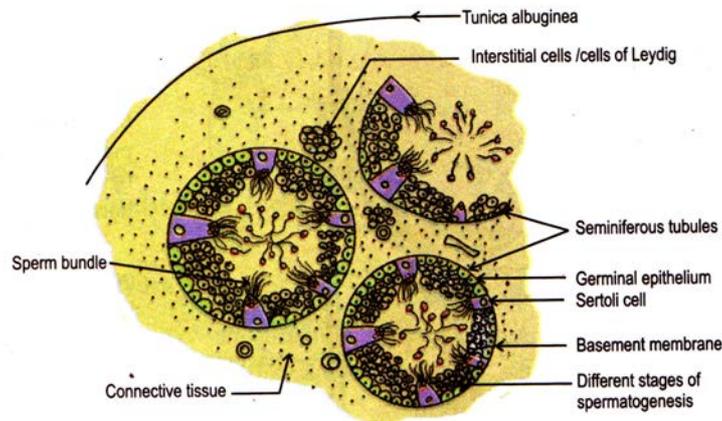
(B) Sketch and label Malpighian body.  
Sol



**Malpighian body**

**Topic : Excretion & Osmoregulation** **Sub topics : Structure of Nephron L-1 XII-HSC Board Biology**

Q. 8 Describe the histology of 'human testis'. Write a note on human sperm  
Sol.

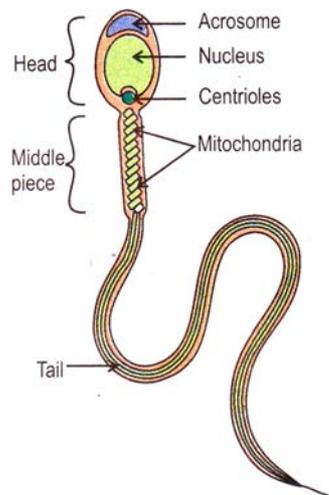


**TS of Human Testis**

**Histology of Testis : -**

Testis is externally covered by fibrous connective tissue called *Tunica albuginea*. It is covered internally by *Tunica vascularis* which is formed by capillaries. Externally it is covered by incomplete peritoneal covering called as *Tunica vaginalis*.

- i) The Transverse section shows presence of seminiferous tubules lined by cuboidal germinal epithelial cells. The germ cell undergoes the process of spermatogenesis.
- ii) Transverse section also reveals different stages of spermatogenesis like spermatogonia, primary and secondary spermatocyte, spermatids and sperm.
- iii) Few large pyramidal cells present between germinal cells are known as sertoli cells, or Nurse cells. The function of sertoli cells is to provide Nourishment of the sperm till maturation.
- iv) Between the seminiferous tubules, are present cluster of polygonal cells known as Interstitial cells or Leydig cells. The leydig cells secrete male sex hormone Testosterone or Androgen.



**Structure of Human Sperm**

**Structure of the Sperm (Spermatozoan) : -**

(Sperm = seed, zoon = animal)

It is microscopic, elongated haploid motile male gamete or paternal gamete measuring about 0.055 mm (60  $\mu$ m) in length. Sperm remains viable for seventy – two hours, but can fertilize the ovum in first 12 to 14 hours only.

**Head :** It is flat and oval region consisting of a large nucleus and an acrosome. Acrosome secretes hydrolytic enzymes like hyaluronidase which helps in penetration of the egg during fertilization. The acrosome and anterior half of nucleus is covered by a fibrillar sheath.

**Neck :** It is a very short region having two centrioles. The proximal centriole plays a role in first cleavage of zygote. The distal centriole gives rise to the axial filament of the sperm.

**Middle piece :** It serves as power house for sperm. It has many mitochondria spirally coiled (Nebenkern) around the axial filament. The mitochondria provide energy for the movement of the sperm in the female genital tract. Posterior half of nucleus, neck, middle piece of sperm are covered by a sheath.

**Tail :** The tail is long, slender and tapering structure formed of cytoplasm. A fine thread, the axial filament arises from the distal centriole and traverse the middle piece and tail.

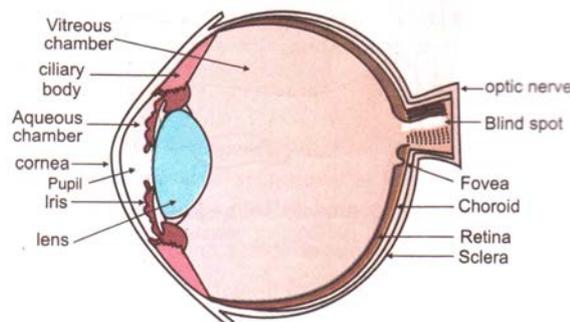
*Topic : Human Reproduction\_ Sub topic : Male Reproduction System\_ L-2\_XII-HSC Board\_\_Biology*

**OR**

With the help of a neat and labelled diagram describe the anatomy of ‘human eye’.

Explain the mechanism of vision.

Sol.



**Anatomy of Human Eye**

A pair of eyes are located in sockets of the skull known as orbits. The human eyeball is nearly a spherical structure. The wall is formed by three layers. The outer layer of dense connective tissue forms sclera. The transparent anterior portion of this layer is termed as cornea. A thin transparent membrane called conjunctiva is present in front of the cornea. The middle layer is called choroid which is bluish in color and contains many blood vessels. The posterior two – third region of this layer is thin, while the anterior part is thick and forms the ciliary body. Forward segment of the ciliary body is pigmented and opaque known as iris. This is the visible colored portion of the eye. A transparent crystalline lens is present anteriorly which is held in position by suspensory ligaments. The aperture surrounded by the iris in front of the lens is known as pupil. The movement of the pupil is regulated by the muscle fibres of iris.

The retina is the innermost layer of the eye. It consists of three sub layers, ganglion cells, bipolar cells and photoreceptor cells sensitive to light. The photoreceptor cells contain light sensitive proteins termed as photopigments. Photoreceptor cells are of two types, rods and cones. The cones are responsible for day light vision and color vision while rods function in dim light. The purple red protein called rhodopsin is present in the rods which is a vitamin A derivative. The cones are of three types that respond to red, green and blue light. Various combinations of these cones and their photopigments produce sensation of different color. The sensation of white light is produced due to simultaneous equal stimulation of all these three types of cones.

The optic nerve leaves the eye at a point slightly away from the median posterior pole of the eyeball. The rods and cones are absent in these regions and hence it is known as blind spot. A yellowish pigmented spot called macula lutea is present lateral to the blind spot with a central pit termed as fovea. It is thinned out portion of retina where only the cones are densely packed and therefore have the greater visual acuity. The aqueous chamber is a space between the cornea and the lens. It contains a thin watery fluid known as aqueous humor. The larger space between the lens and the retina is termed as vitreous chamber. It is filled with the transparent gelatinous fluid known as vitreous humor. The aqueous humor and vitreous humor maintains the shape of the eyeball.

**Mechanism of vision :**

The light rays from the object pass through the cornea and the lens. These are focused on the retina of the eye. The rods and the cones contain photopigments which are conjugated proteins. They are composed of opsin and retinol. The light induces dissociation of retinol from the opsin resulting in changes in structure of opsin. This causes a change in the permeability of retinal cells. It generates an action potential which is carried via bipolar neurons and ganglion cells and further conducted by the optic nerves to the visual cortex of brain. The neural impulses are analyzed and the image formed on the retina is recognized.

*Topic : Control & Coordination\_ Sub topic : Human Eye\_ L-2\_XII-HSC Board\_\_Biology*