Biology

Model Set - 1

Academic Year: 2020-2021 Marks: 70
Date: April 2021
Duration: 3h

1. The question paper is divided into four sections.
2. **Section A**: Q. No. 1 contains Ten multiple-choice type of questions carrying One mark each.
3. **Section A**: Q. No. 2 contains Eight very short answer type of questions carrying One mark each.
4. **Section B**: Q. No. 3 to Q. No. 14 contains Twelve short answer type of questions carrying Two marks each. **(Attempt any Eight)**.
5. **Section C**: Q. No.15 to Q. No. 26 contains Twelve short answer type of questions carrying Three marks each. **(Attempt any Eight)**.
6. **Section D**: Q.No. 27 to Q. No. 31 contains Five long answer type of questions carrying Four marks each. **(Attempt any Three)**.
7. Figures to the right indicate full marks.
8. For each MCQ, the correct answer must be written along with its alphabet. e.g., (a) ..... / (b) .... / (c) .... / (d) ..... Only first attempt will be considered for evaluation.

Q. 1 | Select and write the correct answer:

1.i The outer layer of pollen grain is thick and made up of complex, nonbiodegradable substance called as _____.

1. lignin
2. cellulose
3. pectin
4. sporopollenin

1.ii Fill in the blank:

The primary sex organ in human male is _____.

1. prostate gland
2. seminal vesicle
3. penis
4. testis

1.iii Find the odd one out:

1. H_2A

2. H_3
3. H_2B
4. H1

1.iv Semiconservative mechanism of DNA was detected using:

1. ^{35}S
2. ^{14}C
3. ^{32}P
4. ^{15}N

1.v Most plant cells and tissues constitutes _____ % water.

1. 90-95 %
2. 70-80 %
3. 10-25 %
4. 0-20 %

1.vi A farmer is fed up of weeds in his Wheat farm. Which of the following chemicals he can use to overcome the problem?

1. IBA
2. IAA
3. NAA
4. 2,4 – D

1.vii _____ shows gastric contractions and inhibit the secretion of gastric juice.

1. Gastrin
2. Secretin
3. Entero- gastrone
4. Inhibin

1.viii Saccharomyces cerevisiae is used to produce enzyme _____.

1. Invertase
2. Pectinase
3. Lipase
4. Cellulase

1.ix The ecological niche of population is a_____ A geographical area where it lives.

1. geographical area where it lives.
2. set of conditions and resources that it uses
3. habitat of organisms
4. place of origin of organisms

1.x Lichens taking roots on bare rocks are an example of _____.

1. climax community
2. pioneer species
3. climax species
4. secondary succession

Q. 2 | Answer the following:

2.i Why anther is called as tetrasporangiate structure?

Ans. Due to the presence of four pollen sacs in dithecus anther, it is called as tetrasporangiate structure.

2.ii Why fertilization process in angiosperms is called as double fertilization?

Ans. In fertilization process of angiosperms, both the male gametes participate, due to which fertilization occurs twice in the same embryo sac, hence it is described as double fertilization.

2.iii Name the hydrolytic enzyme secreted by the acrosome.

Ans. Hyaluronidase is secreted by the acrosome.

2.iv What is the role of Mg^{++} in Translation?

Ans. During protein synthesis (translation), Mg^{++} ions act as co-factors for joining two subunits of ribosomes.

2.v What type of isotopes used in semiconservative replication experiment?

Ans. ^{14}N i.e. normal (light) nitrogen and heavy isotope of nitrogen N^{15} was used in semiconservative replication experiment.

2.vi Very short answer question.

Name the ancestor of human which is described as a man with an ape brain.

Ans. Australopithecus is the ancestor of humans which is described as a man with an ape brain.

2.vii Why water acts as a thermal buffer?

Ans. Water has high specific heat, high heat of vaporization, and high heat of fusion. Due to this, it acts as a thermal buffer.

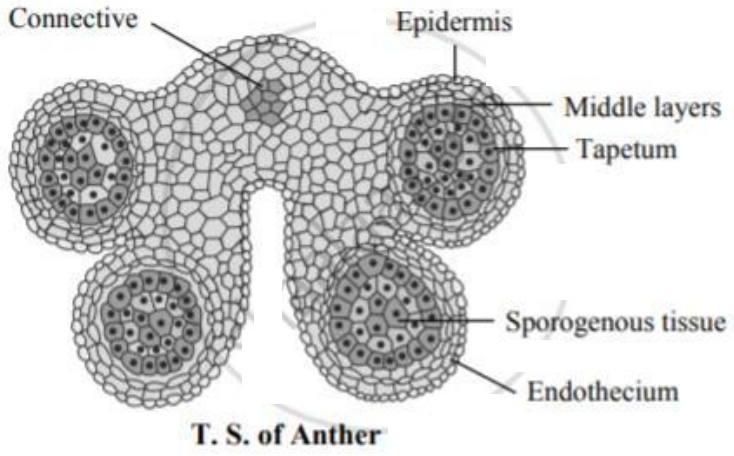
2.viii Buyers often complain that a particular fruit merchant uses some chemical to ripen fruits in his shop. Name the chemical he must be using to do so.

Ans. Ethylene (Ethret/ Ethephon) is used for ripening of fruits.

Q. 3 | Attempt any Eight:

Draw a well labelled diagram of T.S. anther.

Ans.



T. S. of Anther

Q. 4 Answer the following question.

What are the goals of RCH programme.

Ans. A The goals of the Reproductive and Child Healthcare (RCH) programme are as follows:

i. To create awareness among people about various aspects related to reproduction.

ii. To provide facilities to people in order to understand and build up reproductive health.

iii. To provide support for building up a reproductively healthy society.

iv. To bring about a change mainly in three critical health indicators i.e. reducing total infertility rate, infant mortality rate, and maternal mortality rate.

Ans. B The goals of RCH can be achieved by the following ways:

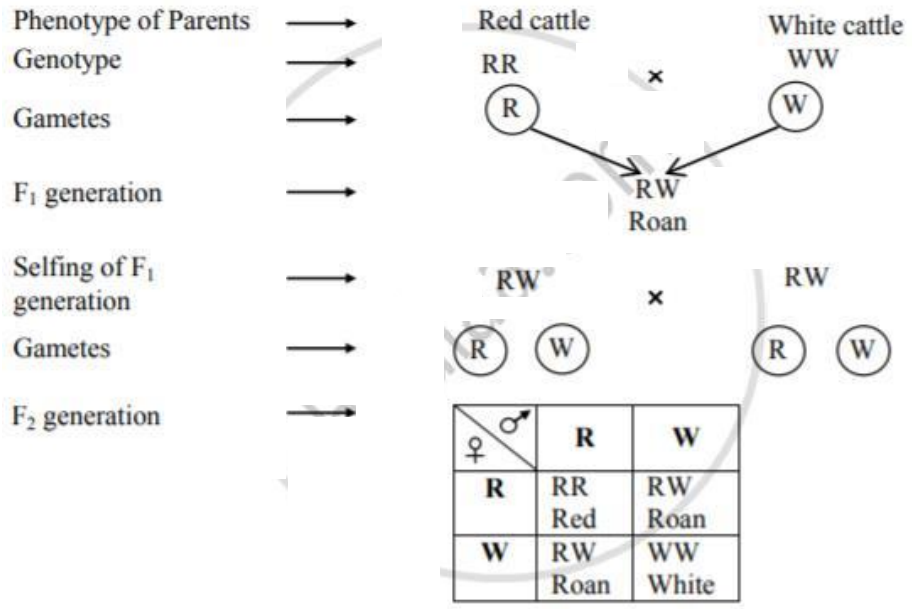
1. By the introduction of sex education in schools. Schools should be encouraged to provide correct information to the young so as to discourage children from believing in myths and clear the misconceptions about sex-related aspects. Proper information about safe and hygienic sexual practices, sexually transmitted diseases (STD, AIDS), problems related to adolescence, and proper information about reproductive organs.

2. With the help of audio-visual and print media, government and non-government organizations should take various steps to create awareness about various aspects related to reproduction.
3. By educating the younger generation about birth control measures, prenatal care of a pregnant woman, and post-natal care of the mother and child, the importance of breast feeding.
4. By developing awareness about problems arising due to uncontrolled population growth, social evils like sex abuse and sex-related crimes and take up necessary steps to prevent them.
5. By creating awareness about a statutory ban on amniocentesis for sex determination.
6. By creating awareness about child immunization programmes.
7. By educating couples to reduce the mortality rate of new borns and maternal mortality rate.

Q. 5 Explain codominance in colour coat in cattle with checker board method.

Ans.

1. Coat colour in cattle is a classic example of co-dominance.
2. There are two types, one with a red coat (skin with red colour hair) and the other with a white coat (with white hair).
3. When red cattle (RR) is crossed with white cattle (WW), F1 hybrids (RW) have roan colour. Roans have a mixture of red and white colour hair.
4. Thus, both traits are expressed equally. In F2 generation (produced by interbreeding of roans), red (RR), roans (RW) and white (WW) are produced in the ratio 1: 2: 1.

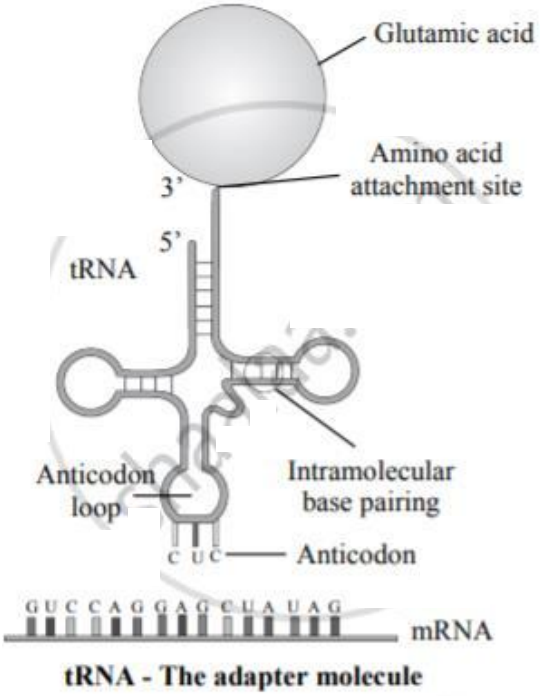


Phenotypic ratio → 1 : 2 : 1 (1 Red coat : 2 Roan : 1 White coat)

Genotypic ratio → 1 : 2 : 1 (1 RR : 2 RW : 1 WW)

Q. 6 How t-RNA act as an adapter molecule?
Explain in detail with the help of a diagram.

Ans. Transfer RNAs are known as adapter molecules in protein synthesis because they are covalently linked to an amino acid at one end and they pair with the mRNA in such a way that amino acids are joined to a growing polypeptide in the correct sequence.



tRNA - The adapter molecule

Q. 7 Distinguish New world and old world monkeys based on their tail along with their examples.

Ans.

No.	New World Monkeys	Old World Monkeys
1.	The New World monkeys have a long non-prehensile tail.	The old-world monkeys have a short non-prehensile tail.
e.g.	Squirrel monkey, spider monkey	Baboons, macaques, etc

Q. 8 In which forms water is available to roots for absorption?

Ans. Some amount of water is held in pores present between the neighbouring soil particles, due to capillarity. This is called capillary water which is available for absorption.

Q. 9 Match the column A with B

	A	B

i.	Epinasty of flower	GA3
ii.	Natural auxin	NAA
iii.	Flowering in Litchi	IAA
iv.	Bolting of Beet	Ethylene

Ans.

	A	B
i.	Epinasty of flower	Ethylene
ii.	Natural auxin	IAA
iii.	Flowering in Litchi	NAA
iv.	Bolting of Beet	GA3

Q.10 A young girl is health conscious. Her dietician advised her to include mushrooms in her diet. What must be the reason?

Ans.

i. Mushrooms are rich in proteins, vitamins, minerals and amino acids.
ii. They are also low in calories. Therefore, dietician advised her to include mushrooms in her diet.

Q. 11 What is Biopiracy? Explain it with respect to Turmeric.

Ans. Definition:

i. Biopiracy is defined as 'theft of various natural products and then selling them by getting patent without giving any benefits or compensation back to the host country'.
ii. Since ancient times, Indians have been using Haldi (Turmeric powder) as antiseptic for healing wounds for killing pests and medicinal purposes

Q. 12 Write a note on uses of somatic cell gene therapy.

Ans. Somatic cell gene therapy:

i. In this type the gene is introduced only in somatic cells like bone marrow cells, hepatic cells, fibroblasts endothelium and pulmonary epithelial cells, central nervous system, endocrine cells and smooth muscle cells of blood vessel walls.
ii. Somatic cell gene therapy is the only feasible option and the clinical trials have already employed for the treatment of acquired disorders such as cancer and rheumatoid arthritis and blood disorders including SCID, Gaucher's disease, familial hypercholesterolemia, haemophilia, phenylketonuria, cystic fibrosis, sickle cell anaemia, Duchenne muscular dystrophy, emphysema, thalassemia etc.

Q. 13 Write full form of

i. IUCN
ii. NBA

Ans.

i. **IUCN:** International Union for Conservation of Nature and Natural Resources
ii. **NBA:** National Biodiversity Authority

Q. 14 Give any four factors that favour high speciation at lower altitudes.

Ans. The factors that favour high speciation at lower latitudes (tropical regions) as compared to higher latitudes (towards the poles) are as follows:

i. Factors like overall stability of tropical regions (at lower latitudes) for millions of years, lesser climatic changes throughout the year and availability of plenty of sunlight have favoured speciation.
ii. Tropical areas have less often experienced drastic disturbances like periodic glaciations observed at poles. Such stability over millions of years might have favoured speciation.
iii. Lesser migrations in tropics might have reduced gene flow between geographically isolated regions and favoured speciation.
iv. Scientists also have considered availability of more intense sunlight, warmer temperatures and higher annual rainfall in tropics, as factors responsible for bountifulness of these regions.

Q. 15 | Attempt any Eight:

Explain water pollination in detail with its types.

Ans. Definition:
Pollination carried out by water is called hydrophily.

Two types of hydrophily:

i. Hypohydrophily:

a. In this pollination occurs below the surface of the water.
b. Here the pollen grains are heavier than water, thus they sink down and caught by stigmas of female flowers.
c. For e.g. In Zostera (sea grass) the pollen grains are long, ribbon-like, and without exine.

ii. Epihydrophily:

a. In this pollination occurs on the surface of the water.
b. The pollen grains float on the water surface and reach the stigma of the female flower.
c. Vallisneria is a submerged dioecious, fresh water aquatic plant. In this, female flowers reach the water surface temporarily to ensure pollination and male flowers float on the surface of the water.

d. The specific gravity of these pollen grains is equal to that of water. Due to which they float on the surface of the water.
e. Due to water currents, pollen grains are carried to stigma and pollination occurs.

Q. 16 Write down the three main concepts of the modern synthetic theory.

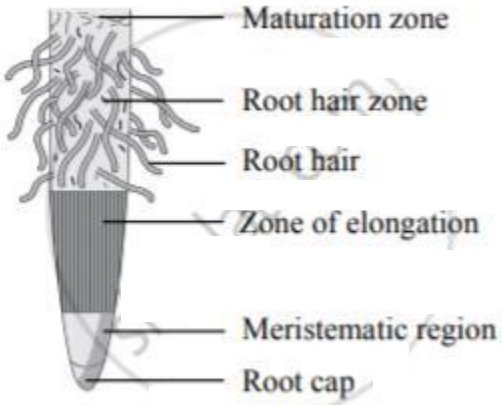
Ans.

The modern synthetic theory gives importance to both mutations and natural selection. The factors involved in Modern synthetic theory can be broadly divided into three main concepts i.e. genetic variation, natural selection, and isolation.

1. **Genetic variations:** They are caused due to various aspects of mutation, recombination, and migration. The change in gene and gene frequencies is known as genetic variation. Genetic variations are caused by factors such as - Gene mutation, genetic recombination, gene flow, genetic drift, chromosomal aberrations.
2. **Natural selection:** Natural selection is the process by which better-adapted organisms grow and produce more number of offsprings in the population. It is the main driving force behind evolution. It states that the fittest organism will get selected by nature and produce more offsprings than organisms that did no adapt to the as per the conditions. It brings about evolutionary changes by favoring differential reproduction of genes that bring about changes in gene frequency from one generation to another. Natural selection invariably encourages those genes that assure the highest degree of adaptive efficiency between a population and its environment.
3. **Isolation:** It is the separation of the population of a particular species into smaller units that prevents interbreeding between them. A barrier that prevents gene flow or exchange of genes between isolated populations, is called isolating mechanism. A number of isolating mechanisms are operated in nature and therefore divergence and speciation may occur. The isolating mechanisms are of two types namely, geographical isolation and reproductive isolation.

Q. 17 Draw a neat and labelled diagram of the Root tip showing the root hair zone.

Ans.



Root tip showing root hair zone

Q. 18 Write the name of_____

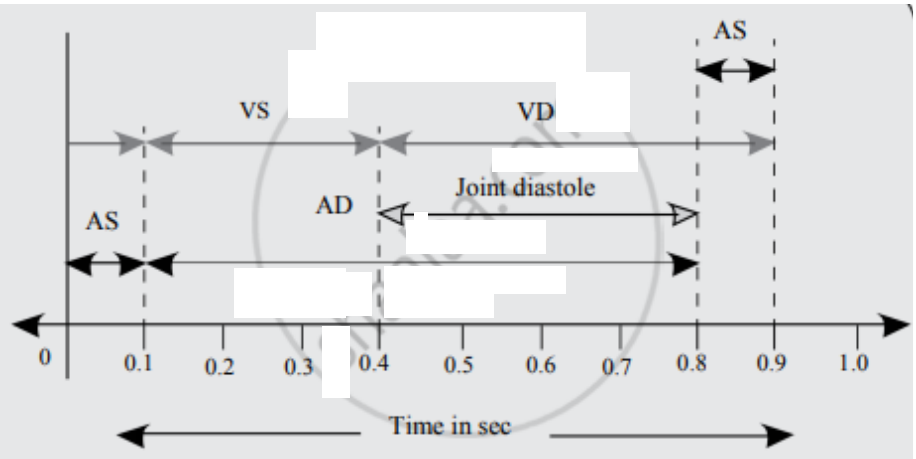
a. First hormone discovered in plants.
b. Biological name of fungus from which Gibberellins were first isolated.
c. The name given to the first cytokinin by Skoog and Miller.

Ans.

a. Auxin
b. Gibberella fujikuroi
c. Kinetin

Q. 19 Draw diagrammatic representation of cardiac cycle. Explain ventricular systole.

Ans. Diagrammatic representation of Cardiac Cycle



Ventricular systole (VS):

i. The impulse originating from SA node reaches the AV node and it gets excited. The AV node sends impulses to bundle of His and from bundle of His to Purkinje fibers. Purkinje fibers further spread impulses all over the wall of ventricles.
ii. Due to this, ventricular wall contracts causing ventricular systole. During ventricular systole, right ventricle pumps deoxygenated blood into pulmonary trunk and left ventricle pumps oxygenated blood into aorta.
iii. During ventricular systole the cuspid valves close both the atrioventricular apertures preventing blood flow into atria (lubb sound is heard).

Q. 20 Write a note on Hering-Breuer reflex.

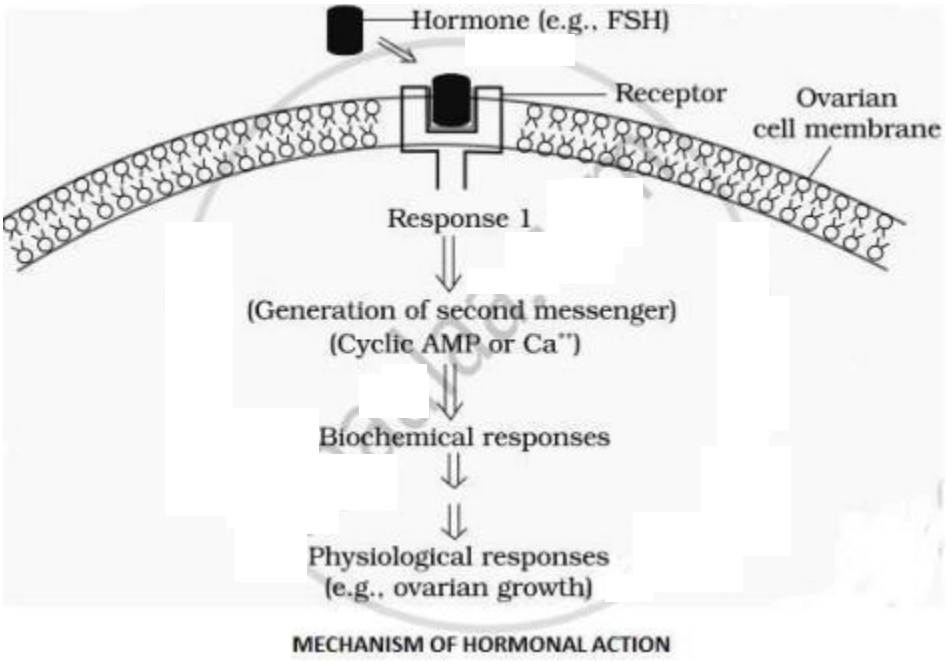
Ans.

i. During inspiration, when the lungs expand to a critical point, the stretch receptors are stimulated and impulses are sent along the vagus nerves to the expiratory centre. It then sends out inhibitory impulses to the inspiratory center. The inspiratory muscles relax and expiration follows.

ii. As air leaves the lungs during expiration, the lungs are deflated and the stretch receptors are no longer stimulated. Thus, the inspiratory centre is no longer inhibited and a new respiration begins. These events are called the Hering-Breuer reflex.

iii. The Hering-Breuer reflex controls the depth and rhythm of respiration. It also prevents the lungs from inflating to the point of bursting.

Q. 21 Answer the questions after observing the diagram given below.



MECHANISM OF HORMONAL ACTION

1. What acts as the first messenger?
2. Why can't hormones like catecholamines enter their target cells through plasma membrane?
3. Name the mode of hormone action shown in the diagram.

Ans.

1. The hormone acts as the first messenger
2. Hormones like catecholamines are not lipid soluble and hence they cannot enter their target cells through the plasma membrane.
3. Mode of hormone action through membrane receptor.

Q. 22 Describe any three functions of hypothalamus.

Ans. Functions of hypothalamus:

i. It regulates heart rate, respiration, blood pressure (B.P.), body temperature, water and electrolyte balance.

ii. It has centres for hunger, thirst, sleep, fatigue, satiety centre, secretion of glands of stomach and intestine. It also produces neurohormones that stimulate the pituitary gland.
iii. Major function of hypothalamus is maintaining homeostasis.

Q. 23 State any three benefits of using Biogas.

Ans.

i. It is a cheap, safe and renewable source of energy.
ii. It can be easily generated, stored and transported.
iii. It can be used for domestic lighting, cooking, street lighting as well as small scale industries.

Q. 24 Define biotechnology? Which are the basic principles and process of biotechnology?

Ans. Definition:

Biotechnology refers to the development and utilization of biological forms, products or processes for obtaining maximum benefits to man and other forms of life.

i. Biotechnology is based on the principles of chemical engineering, genetic engineering and adequate maintenance of sterile conditions.
ii. **Following are the processes used in biotechnology:**
   a. Repairing of the defective genes or replacing of defective genes by healthy genes or normal genes;
   b. Artificially synthesizing of a totally new gene

Q. 25 Explain any three important characteristics of population.

Ans. Some important characteristics of population are:

i. Population density: Density of a population is the total number of individuals in that population present per unit area at a specific time.
ii. Natality: Natality is the birth rate of a population.
iii. Mortality: Mortality is the death rate of a population.

Q. 26 Explain the progress of ecological succession in newly formed volcanic island.

Ans.

i. Primary succession starts at places where no living organisms were present before like a newly formed volcanic island.
ii. Before a biotic community of diverse organisms can be established, there must be soil. Depending mostly on climate, it takes natural processes, several hundred to several thousand years to produce fertile soil on bare rock.
iii. The species which invade a bare area and initiate the succession are called pioneer species. Crustose lichen grows on the rocks which secretes acid to dissolve rock. This helps in weathering of rocks and formation of soil.
iv. These conditions become favourable for the next community i.e. bryophytes and mosses take hold of the small amount of soil.

Q. 27 | Attempt any Three: Answer the following question.
Describe the various methods of birth control to avoid pregnancy.

Ans. Contraceptive methods are of two main types i.e. temporary and permanent.

1. Temporary methods:

i. Natural method/ Safe period / Rhythm method:

In the natural method, the principle of avoiding chances of fertilization is used. A week before and a week after menstrual bleeding is considered a safe period for sexual intercourse.
This method is based on the fact that ovulation occurs on the 14th day of the menstrual cycle. Drawback: High rate of failure.

ii. Coitus Interruptus or withdrawal:

In this method, the male partner withdraws his penis from the vagina just before ejaculation, so as to avoid insemination.
Drawback: Pre-ejaculation fluid may contain sperms and this can cause fertilization.

iii. Lactational amenorrhea (absence of menstruation):

This method is based on the fact that ovulation does not occur during the period of intense lactation following parturition. Therefore, as long as the mother breastfeeds the child fully, chances of conception are almost negligible.
Drawbacks: High chances of failure.

iv. Chemical means (spermicides):

In this method, chemicals like foam, tablets, jellies, and creams are used by the female partner. Before sexual intercourse, if these chemicals are introduced into the vagina, they adhere to the mucous membrane, immobilize and kill the sperms.
Drawback: It may cause allergic reaction. This method also has chances of failure.

v. Mechanical means / Barrier methods:

In this method, the ovum and sperm are prevented from physically meeting with the help of barriers.

These mechanical barriers are of three types.:

1. Condom:

It is a thin rubber sheath that is used to cover the penis of the male during copulation. It prevents the entry of ejaculated semen into the female reproductive tract. It can thus prevent conception. It is a simple and effective method and has no side effects. Condoms should be properly discarded after every use. A condom is also a safeguard against STDs and AIDS.
e.g."Nirodh" is the most widely used contraceptive by males. It is easily available and is given free by the government.

2. Diaphragm, cervical caps and vaults:

These devices used by the female are made up of rubber. They prevent conception by blocking the entry of sperms through the cervix. The device is inserted into the female reproductive tract to cover the cervix during copulation.

3. Intra-uterine devices (IUDs):

These clinical devices are plastic or metal objects. A doctor or trained nurse places the IUDs into the uterus. These devices include the Lippes loop, copper releasing IUDs (Cu-T, Cu7, multiload 375), and hormone-releasing IUDs (LNG-20, progestasert).

- **Lippes loop:**
  It is a plastic double "s" loop. It attracts the macrophages stimulating them to accumulate in the uterine cavity. Macrophages increase phagocytosis of sperms within the uterus and act as a contraceptive.
- **Copper releasing IUDs:**
  Suppress sperm motility and the fertilizing capacity of sperms.
- **Hormone releasing IUDs:**
  Make the uterus unsuitable for implantation and cervix hostile to the sperms. It delays pregnancy for a longer period.
  Drawbacks: Spontaneous expulsion, occasional haemorrhage and chances of infection are the drawbacks of IUDs.

vi. Physiological (Oral) Devices:

Physiological devices are used in the form of tablets/ pills. It is an oral contraceptive, used by the female which contains progesterone and estrogen. These hormones inhibit ovulation; hence no eggs are released from the ovary of the female using this pill and thus conception cannot occur.

They also alter the quality of cervical mucus to prevent the entry of sperms. The pill "Saheli" is an oral contraceptive for females which is non-steroidal. Saheli is to be taken once in a week. These pills are sponsored by the Government. Saheli is now a part of the National Family Programme as an oral contraceptive pill in India.

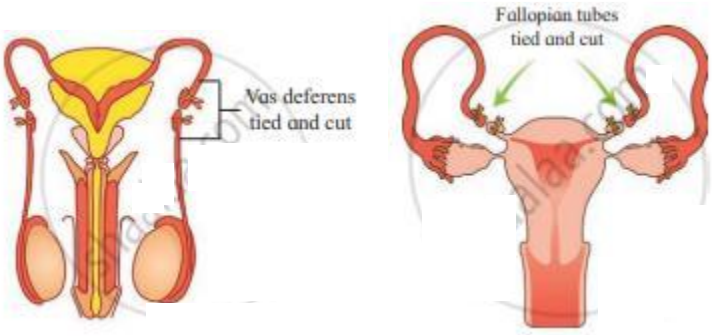
Drawback: Oral contraceptive pills have side effects such as nausea, weight gain, tenderness of breast, and slight blood loss between menstrual periods.

vii. Other contraceptives:

The birth control implant is a contraceptive used by the female. e.g. implanon, explanon, etc. It is a tiny, thin rod about the size of a matchstick. It is implanted under the skin of the upper arm and contains progesterone and estrogen. Their mode of action is similar to that of pills. They prevent pregnancy for 3-4 years.

2. Permanent Methods:

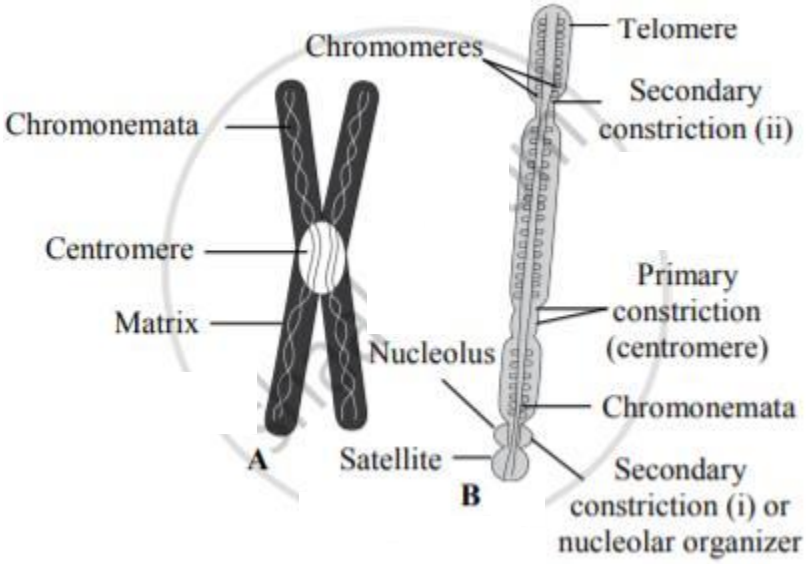
The permanent birth control method in men is called vasectomy and in women it is called tubectomy. These are surgical methods, also called sterilization. In vasectomy a small part of the vas deferens is tied and cut. In tubectomy, a small part of the fallopian tube is tied and cut. This blocks gamete transport and prevent pregnancy.



Q. 28 Explain the structure of chromosomes with labelled diagram.

Ans. Structure of chromosome:

1. A typical chromosome consists of two chromatids joined together at the centromere also known as primary constriction.
2. Primary constriction consists of a disk shape plate called the kinetochore. During cell division, spindle fibers get attached to the kinetochore.
3. Apart from primary constriction, a few chromosomes possess an additional one or two constrictions called secondary constriction.
4. At secondary constriction I (nucleolar organizer), nucleolus becomes organized during interphase.
5. A satellite body (SAT body) is attached at secondary constriction II, in very few chromosomes.
6. Each chromatid in turn contains a long, unbranched, slender, highly coiled double-stranded DNA thread, called chromonema, extending through the length of the chromatid.
7. The ends of chromosomes (i.e. chromatids) are known as telomeres.

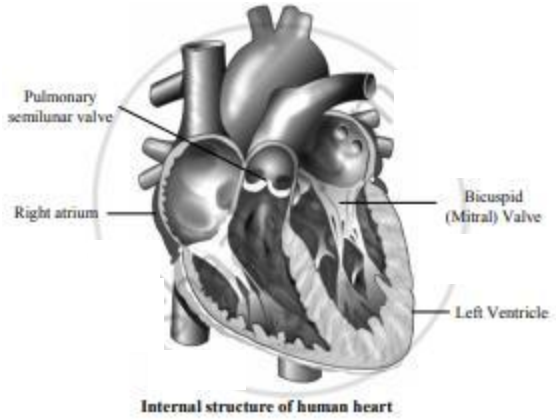


A: Parts of chromosomes
B: Showing secondary constrictions and details
Structure of Chromosome

Q. 29 Draw labelled diagram of internal structure of human heart.

Label right atrium, mitral valve, left ventricle and pulmonary semilunar valve.
Write a function of Eustachian and tricuspid valve found in human heart.

Ans.



Internal structure of human heart

i. Eustachian valve guards the opening of the postcaval vein (inferior vena cava).
ii. The tricuspid valve is present in the right AV aperture and prevents backflow of blood, maintaining a unidirectional blood flow.

Q. 30 Write a note on the four different kinds of cell in Pancreas.

Ans. Islets of Langerhans are endocrine cells of pancreas. They are four types of cells in Islets of Langerhans which have endocrine role i.e. they secrete hormones.

i. **Alpha cells (α cells):** They constitute 20% of Islets of Langerhans. They secrete hormone glucagon. Glucagon stimulates glycogenolysis (breakdown of glycogen) in liver which may cause hyperglycemia.
ii. **Beta cells (β cells)**: They constitute 70% of Islets of Langerhans. They secrete insulin which stimulates glycogenesis (formation of glycogen) in liver and muscles. Insulin causes hypoglycemia by increasing uptake of glucose by cells.
iii. **Delta cells (δ cells)**: They constitute 10% of Islets of Langerhans. These cells secrete somatostatin which inhibits the secretion of insulin and glucagon. It also lowers the gastric secretions, motility and absorption in digestive tract. Somatostatin inhibits the release of growth hormone.
iv. **PP cells or F cells**: These cells secrete pancreatic polypeptide (PP) and inhibit the release of pancreatic juice.

Q. 31 Explain the mode of transmission of HIV.

Ans. Modes of transmission of AIDS:

i. **Unsafe sexual contact**: Including oral, vaginal and anal sex.
ii. **Blood**: Through blood transfusions or needle sharing.
iii. **From mother to child (Transplacental)**: A pregnant woman can transmit the virus to her foetus through their shared blood circulation, or a nursing mother can transmit it to her baby from her breast milk.