MODEL QUESTION PAPER SET- 2 : 2021 - 22

MM : 70 **BIOLOGY THEORY SOLUTIONS** **Time : 3 Hrs**

Entire Syllabus

SECTION A

Q.1 Select & Write the correct Answer **10M**

i. c) insect resistance **1M**

ii. d) All of these **1M**

iii. c) Gibberellins **1M**

iv. a) 3 **1M**

v. d) Tyrosine **1M**

vi. **b)** palatine **1M**

vii. Saccharomyces **1M**

viii. c) Overexploitation of resources **1M**

ix. **c)** Random mating **1M**

x. **b)** Capillary water **1M**

Q.2 Short Answers (1 Mark Each) **8M**

i. a) bacteria **1M**
b) lions and leopards

ii. Epiglottis prevents food from entering the trachea. **1M**

iii. IAA – Indole – 3 – acetic acid **1M**

iv. The transmission of genetic information from generation to generation is known as heredity or inheritance. **1M**

v. Farmers and gardeners are advised to buy hybrid seeds every year because the traits of the plants segregate in the progeny as per Mendel's law of segregation. Due to this, new progeny plants may not have desired traits. **1M**

vi. **Four regions of a typical root:** **1M**
Zone of maturation, zone of absorption (root hair region), zone of elongation and meristematic region.

vii. Sympathetic nervous system controls body activities during fight, fright or flight situations. It activates the release
of hormones adrenaline and nor-adrenaline due to which the heart beat increased, hands and feet become cold. **1M**

viii. The length of DNA can be calculated by multiplying the numbe of base pairs with the distance between two consecutive base pairs. **1M**

SECTION B

Attempt Any Eight Questions **16M**

Q.3 Pleiotropy : **2M**

(1) When a single gene controls two or more different traits, it is called a pleiotropic gene and the phenomenon is known as pleiotropy or pleiotropism. The pleiotropic ratio is always 1 : 2 instead of normal

3 : 1. In pleiotropy a single gene produces two different expressions.

(2) Sickle-cell anaemia is caused by the gene HbS. The healthy or normal gene which is dominant is Hb_A. The heterozygotes or carriers i.e., HbA/Hbs show anaemia as there is deficiency of haemoglobin due to sickling of RBCs. Abnormally low concentration of oxygen can cause sickling of RBCs.

(3) The homozygotes possessing the recessive gene HbS die because of fatal anaemia because the gene for sickle-cell anaemia is lethal in homozygous condition and causes sickle-cell trait in heterozygous carrier.

(4) When two carriers are married they will produce normal carriers and sickle-cell anaemic children in the ratio of 1 : 2 : 1. Out of these three children sickle-cell anaemic child will die leaving the ratio 1 : 2 instead of 3 : 1.

Q.4 Effects after application of gibberellins : **2M**

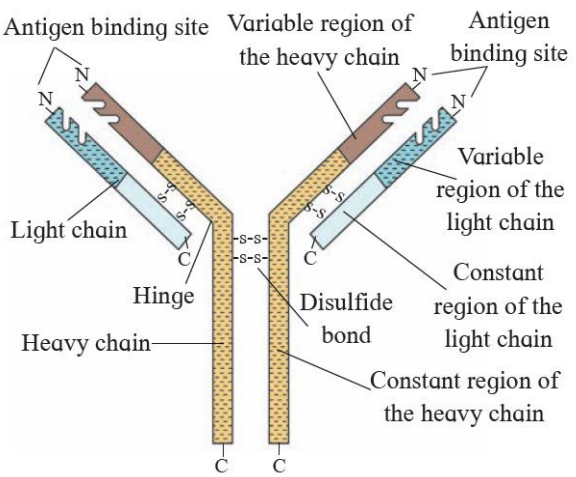
(1) Gibberellins break dormancy of bud, dormancy of seed.

(2) They promote seed germination in cereals by activating or synthesising enzyme amylase to produce sugar.

(3) Gibberellins induce elongation of the cells in stem hence increase in internode length is noticed.

(4) In rosette plants like cabbage it causes 'bolting' that is increase in internode length before flowering.

Q.5 **2M**



Structure of antibody

Q.6 **2M**

No	Antibiotic	Microbial source
1	Chloromycetin	Streptomyces venezuelae
2	Erythromycin	Streptomyces erythreus
3	Penicillin	Penicillium chrysogenum
4	Streptomycin	Streptomyces griseus

Q.7 **2M**

Hibernation	Aestivation
Hibernation is a state of reduced activity in some organisms to escape cold winter conditions.	Aestivation is a state of reduced activity in some organisms to escape desiccation due to heat in summers
Bears and squirrels inhabiting cold regions are examples of animals that hibernate during winters.	Fishes and snails are examples of organisms aestivating during summers.

Q.8 **2M**

a) **Hypersecretion of thyroid hormones:** It is caused by an increase in the levels of thyroid hormones. This increases metabolic rate, sensitivity, sweating, flushing. rapid respiration. bulging of eyeballs. and affects various physiological activities. Graves' disease: Hyperthy roidism in adults results in this disorder. It is characterised by protruding eyeballs, increased BMR, and weight loss. Increased BMR produces a range of effects like increased heartbeat, increased B.P., higher body temperature, nervousness, irritability, and tremor of fingers,

b) **Simple goitre:** It is iodine deficiency goitre. Iodine is required for the synthesis of thyroid hormone and if there is a deficiency of iodine in the diet, it causes enlargement of the thyroid gland leading to simple goitre. This disease is common in hilly areas.
Addition of iodine to table salt prevents this disease. The size of the thyroid gland is increased but the total output of thyroxine is decreased.

Q.9 **2M**

i. Clotting or coagulation is the process of converting the liquid blood into a solid form. This process may be initiated by contact of blood with any foreign surface (intrinsic process) or with damaged tisues (extrinsic process).
ii. Intrinsic and extrinsic processes involve interaction of various substances called clotting factors by a step wise or cascade mechanism.
iii. There are in all twelve clotting factors numbered as I to XIII (factor VI is not in active use). Interaction of these factors occurs in cascade manner leading to formation of the enzyme thrombin.
iv. Thromboplastin helps in the formation of enzyme prothrombinase. This enzyme inactivates heparin and it also converts inactive prothromb in into its active thrombin.
v. Thrombin converts soluble blood protein fibrinogen into insoluble fibrin. Fibrin a mesh in which platelets and other blood cells are trapped to form the clot.

Q.10 Structure of root hair: **2M**

i. Root hair is cytoplasmic extension (prolongation) of epiblema cell.
ii. Each root hair may be approximately 1 to 10 mm long and tube like structure.
iii. It is colourless, unbranched, short-lived (ephemeral) arid very delicate.
iv. It has a large central vacuole surrounded by thin film of cytoplasm, plasma membrane and thin cell wall, which is two layered.
v. Outer layer is composed of pectin and inner layer is made up of cellulose.
vi. Cell wall of a root hair is freely permeable but plasma membrane is selectively permeable.

Q.11 i. If a PCR machine fails to lower the temperature below 70°C then the annealing step (in which primers attach to the respective ends of DNA template) would be affected. **2M**

ii. Annealing step of PCR requires temperature ranging between 40°C to 60°C therefore, if a PCR machine fails to lower the temperature below 70°C, primers will not attach to the DNA templates.

Q.12 Dryopithecus: **2M**

a. They were ape like in appearance
b. The fossil of this ape was discovered on an island in Lake Victoria of Africa.
c. Recently an almost complete lower jaw of a Dryopithecus was Haritalyanga (Bilaspur district, Himachal Pradesh).
d. This ape lived in Miocene epoch about 20-25 million years ago.
e. It exhibited close similarity to chimpanzee.
f. They had a semi-erect posture.

Q.13 (1) Endosperm, that is developed after fertilization is a nutritive tissue for developing embryo. **2M**
(2) Endosperm stores food material.
(3) In some seeds this reserved food is partially utilized by embryo for development, E.g; Castor.
(4) The endosperm remains in the seed and it is utilized further during seed germination.

Hence the seed is endospermic or albuminous.

Q.14 **2M**

	Primary Succession	Secondary Succession
i.	It starts in the area where no living organisms ever existed	It starts in an area which has lost all the living organisms once existed
ii.	It starts in an area like bare rocks, newly formed pond or reservoir, cooled lava etc.	It starts in an area like abandoned farm, cut or burnt forest, flooded land etc.
iii.	It is a very slow process.	It is comparatively faster process.

SECTION C

Attempt Any Eight Questions **24M**

Q.15 i. Loss of biodiversity leads to the overall imbalance in the ecosystem. **3M**
ii. Loss of biodiversity in any area can lead to the decline in plant production, lower resilience to environmental disturbance like flood.

iii. It may also lead to alteration in environmental processes like disease cycles, plant productivity, etc. hence, loss of biodiversity can harm the ecosystem.

Q.16 On the basis of nature and function biofertilizers are divided into following groups: **3M**

i. N_2 fixing Biofertilizers:

a. The nitrogen fixing microorganisms which convert atmospheric nitrogen into nitrogenous compounds like nitrites and nitrates via ammonia.

b. Nitrogen fixing microorganisms, also called diazotrophs, are of

1. Symbiotic N_2 fixing microorganisms.

These are always associated generally with underground parts i.e. roots of higher plants. For e.g. Rhizobium, Anabaena, Frankia.

2. Free-1iving or Non- Symbiotic N2 fixing microorganisms:

E.g. Azotobacter, Nostoc, Clostridium, Beijerinkia, Klebsiella, etc.

ii. Phosphate solubilizing biofertilizers:

These are the bacterial species which solubilize the insoluble inorganic phosphate compound, such as rock phosphate.

For e.g. Pseudomonas striata, Bacillus polymyxa, Agrobacterium Microccocus, Aspergillus spp., etc.

iii. Compost making biofertilizers:

Composting is a natural process that turns organic material into a dark rich substance called as Compost or humus.

The composting process is dependent on microorganisms to break down organic matter into compost.

There are many types of microorganisms found in active compost such bacteria, fungi, actinobacteria, protozoa and rotifers.

iv. Cyanobacteria as biofertilizers:

Many cyanobacteria are aquatic and terrestrial, free-living or symbiotic aerobic, photosynthetic, N_2 fixing, heterocystous or non-heterocystous forms.

e.g. Anabaena, Nostoc, Plectonema, Oscillatoria, etc.

Anabaena, Nostoc and Tolyporhrix are associated with lichens while Anabaena is associated with plants like Azolla and Cycas.

v. Fungal biofertilizers:

Mycorrhiza is a fungus. It forms symbiotic association with the parts like rhizomes and root of higher plants occurring in thick humid forests.

Q.17 Effects of Drug Alcohol Abuse: **3M**

i. Behavioural changes: The immediate adverse effects of drugs and alcohol abuse are manifested in the form of reck1ess behaviour, vandalism and violence.

ii. Coma/Death: Excessive doses of drugs may lead to coma and death due to respiratory failure, heart failure or cerebral hemorrhage. A combination of drugs or their intake along with alcohol genera11y results in overdose and even deaths.

iii. Social changes: The most common warning signs of drug and alcohol abuse among youth include drop in academic performance, unexplained absence from school/college, lack of interest in personal hygiene, withdrawal, isolation, depression, fatigue, aggressive and rebellious behaviour, deteriorating relationships with family and friend, loss of interest in hobbies, change in sleeping and eating habits, fluctuations in weight, appetite, etc.

iv. **Crimes:** If an abuser is unable to get money to buy drugs/alcohol he/she may turn to crime. At times, a drug/alcohol addict becomes the cause of mental and financial distress to his/her entire family and friends.

v. **Adverse health effects/Diseases:** Those who take drugs intravenously (direct injection into the vein using a needle and syringe) are likely to aquire serious infections like HIV and hepatitis B. Use of alcohol during adolescence may also have long-term effects like loss balance. liver cirrhosis, pancreatitis. It could lead to heavy drinking in adulthood.
Chronic use of drugs and alcohol damages nervous system and liver (cirrhosis). Use of drugs and alcohol during pregnancy adversely affects the foetus.

vi. **misuse in Sports.** Another misuse of drugs is that certain sports persons use drugs to enhance performance.
They (mis)use narcotic analgesics. anaholic steroids, diuretics and certain hormones to increase muscle strength and bulk and to promote aggressiveness and overall improvement in their performance.

vii. **Side-effects of the use of anabolic steroids in females:** Masculinization (features like males), increased aggressiveness, mood swings. depression, abnormal menstrual cycles, excessive hair growth on the face and body, enlargement of clitoris, deepening of voice.

viii. **Side-effects of the use of anabolic steroids in males:** Acne, increased aggressiveness, mood swings, depression, and reduction of size of the testicles. decreased sperm production. kidney and liver dysfunction, breast enlargement. premature baldness, enlargement of the prostate gland. These effects may be permanent with prolonged use.

Q.18 i. Cerebrospinal fluid (CSF) is lymph like extra cellular fluid, secreted by the choroid plexuses of pia mater which is present inner to sub arachnoid space in the ventricles of the brain and within the central canal of spinal cord and ependymal cells lining the ventricles of brain and central canal of spinal Cord **3M**

ii. CSF is drained from brain to the outside into the blood stream by the three openings in the roof of medulla oblongata.

iii. CSF is slightly alkaline fluid with a specific gravity of 1.005.

iv. A total of 100-200 cc of CSF is present in and around the CNS.

v. CSF is continuously generated by the ependymal cells lining the ventricles and central canal and simultaneoulsy drained out of the brain into the blood stream.

Functions of CSF:

i. The meninges and CSF act as a shock absorber and protect the brain and spinal cord from mechanical injuries.

ii. It also maintains constant pressure inside cranium.

iii. It helps in exchange of nutrients and wastes between blood and brain tissue.

iv. It helps in the supply of oxygen to the brain.

v. It protects the brain from desccation.

Q.19 **3M**

No.	Arteries	Veins
i.	They carry blood away from the heart to various parts/organs of the body.	The carry blood towards the heart from various parts/organs of the body.
ii.	Blood flows under great pressure.	Blood flows under less pressure.
iii.	They are thick walled.	They are thin walled.
iv.	Arteries branch into arterioles and further into fine capillaries	Venules are small vessels that continue from capillaries and merge to form veins.
v.	These are deeply situated except a few like the radial, brachial, femoral, etc. Which are superficially located.	Mostly superficial in location.
vi.	They carry oxygenated blood, except pulmonary artery.	They carry deoxygenated blood, except pulmonary vein.
vii.	Tunica media is comparatively thicker.	Tunica media is comparatively thinner.
viii.	They do not have valves.	They have valves to prevent the backflow of the blood

Q.20 **3M**

i. induce rooting in a twig: Auxins
ii. quickly ripen a fruit: Ethylene
iii. delay leaf senescence: Cytokinins
iv. induce growth in axillary buds: Cytokinins
v. 'bolt' a rosette plant : Gibberellins
vi. induce immediate stomatal closure in leaves: Abscisic acid

Q.21 **Properties of water:** **3M**

i. Water is in the liquid form at room temperature and is the best solvent for most of the solutes.
ii. In pure form, it is inert inorganic compound with neutral pH. Due to this, water is the best transporting medium for dissolved minerals and food molecules.
iii. It is best aqueous medium for all biochemical reactions occurring in the cells.
iv. It is an essential raw material for photosynthesis.
v. Water has high specific heat, high heat of vaporization and high heat of fusion. Due to this, it acts as thermal buffer.
vi. Water molecules have good adhesive and cohesive forces of attraction. .
vii. Due to high surface tension and high adhesive and cohesive force, it can easily rise in the capillaries.

These properties of water make it a significant molecule that connects physical world with biological processes.

Q.22 **3M**

i. Natural selection encourages those genes or traits that assure highest degree of adaptive efficiency between population and its environment.
ii. Industrial melanism is one of the best examples for natural selection.
iii. In Great Britain, before industrialization (1845) grey white winged moths (Biston betularia) were more in number than black-winged moth (Biston carbonaria).
iv. These moths are nocturnal and during day time they rest on tree trunk.
v. White-winged moths were camouflaged (hide in the background) well with the lichen covered trees that helped them to escape from the predatory birds.
vi. However, the black-winged moth resting on lichen covered tree trunks were easy victims for the predatory birds and their number was reduced.
vii. During industrial revolution, large number of industries came up in Great Britain.
viii. The industries released black sooty smoke that covered and killed the lichens growing on tree and turn the tree black due to pollution.

ix. This change became an advantage to the black-winged moths that camouflaged well with the black tree trunks and their number increased
x. The white-winged moths however became victims to predatory birds due to which their number reduced.

Thus, natural selection has resulted in the establishment of a phenotypic trait in the changing environmental conditions.

Q.23 The technique used by forensic investigators to identify and confirm the criminal is DNA fingerprinting. **3M**

The steps of the DNA fingerprinting technique are as follows:

i. **Isolation of DNA:** The DNA must be isolated from the cells or tissues of the body (host).
Only small amount of tissue like blood, hair roots, skin, etc. is required.

ii. **Restriction digestion:** The isolated DNA is treated with restriction enzymes. The restriction enzymes cut the DNA into small fragments having variable lengths. This phenomenon is called Restriction Fragment Length Polymorphism (RFLP).

iii. **Gel electrophoresis:** The DNA samples are loaded for agarose gel electrophoresis under an electric influence.
The DNA fragments, which are negatively charged move to the positive pole. The movement of these fragments depends on length of the fragments. This results in formation of bands. dsDNA splits into ssDNA by alkali treatment.

iv. **Southern blotting:** The separated DNA fragments are transferred to a nylon membrane or a nitrocellulose filter paper by placing it over the gel and soaking them with filter paper overnight.

v. **Selection of DNA probe:** A known sequence of single-stranded DNA is prepared. It is called DNA Probe.
DNA probe is obtained from organisms or prepared by cDNA preparation method. The DNA probe is labelled with radioactive isotopes.

vi. **Hybridization:** Probe DNA is added to the nitrocellulose filter paper containing host DNA. The single-stranded DNA probe pairs with the complementary base sequence of the host DNA strand. As a result, DNA-DNA hybrids are formed on the nitrocellulose filter paper. Remaining single stranded DNA probe fragments are washed off.

vii. **Photography:** The nitrocellulose filter paper photographed on an X-ray film by autoradiography. The film is analysed to determine the presence of hybrid DNA.

Q.24 i. Thalassemia is an autosomal, inherited recessive disease. **3M**
ii. Haemoglobin molecule is made of four polypeptide chains - 2 alpha (a) and 2 beta (b) chains.
iii. The synthesis of alpha chains are controlled by two closely linked genes (HBA_1 and HBA_2) on chromosome 16 while the synthesis of beta chain is controlled by a single gene (HBB) on chromosome 11.
iv. Depending upon which chain of haemoglobin is affected, Thalassemia is classified as alpha-thalassemia and beta-thalassemia
v. It is caused due to deletion or mutation of gene which codes for alpha (a) and bcta (b) globin chains that result in abnormal synthesis of haemoglobin.
vi. In Thalassemia, person shows symptoms like anaemia, pale yellow skin, change in size and shape of RBCs, slow growth and development, dark urine, etc.

vii. Massive blood transfusion is needed to these patients.
viii. Thalassemia differs from sickle-cell anaemia.
Thalassemia is a quantitative problent of synthesising few globin molecules, while sickle cell anaemia is a qualitative problem of synthesising an incorrectly functional globin.

Q.25 The causative agent of gonorrhea is Neisseria gonorrhoeae (Bacteria). **3M**
Generally, the bacteria infect people through the mucous membrane of the urino-genital tract, rectum, throat and eye.
Alter exposure to the bacteria, the person is most likely to show symptoms after 2-4 days in males and 7-21 days in females.
The symptoms of gonorrhea are as follows:
i. In males, partial blockage of urethra and reproductive ducts, pus from penis, pain and burning sensation during urination, arthritis. etc.
ii. In females, pelvic inflammation of urinary tract, sterility, arthritis, the children born to affected mother suffer from gonococcal ophthalmia and gonococcal vulvovaginitis.
Cure:
Antibiotic-Cefixirne
Preventive measures:
Sex hygiene, using condom during coitus, avoiding sex with unknown partner or multiple partners.

Q.26 Genetic diversity is an essential factor for evolution by natural selection. Continued self-pollination results in the inbreeding depression. Thus, plants have developed many devices to encourage cross pollination. The examples of outbreeding devices are as follows: **3M**
i. Unisexuality: In this, the plant bears either male or female flowers. It is also called as dioecism.
As flowers are unisexual, self-pollination is not possible.
Plants may be monoecious, e.g. Maize or dioecious, e.g. Mulberry, Papaya.
ii. Dichogamy: In this, anthers and stigmas mature at different times in a bisexual flower due to which self—
pollination is prevented.
It can be further divided into two types:
Protandry: In this type, anthers mature first, and the stigma of the same flower is not receptive at that time. e.g. in the disc florets of sunflower.
Protogyny: in this type, stigma of carpel matures earlier than anthers of the same flower. e.g. Gloriosa.
iii. Prepotency: In this, pollen grains of other flowers germinate rapidly over the stigma than the pollen grains from the same flower, e.g. Apple.
iv. Heterostyly (heteromorphy): Plants like Primula (Primrose) produce two or three types of flowers in which stigmas and anthers arc placed at different levels (heterostyly and heteroanthy).
This prevents the pollens from reaching the stigma and pollinating it.
In heteromorphic flowers, pollen grains produced front anther pollinate stigmas produced at the same level.
Thus self-pollination is not possible in such cases.

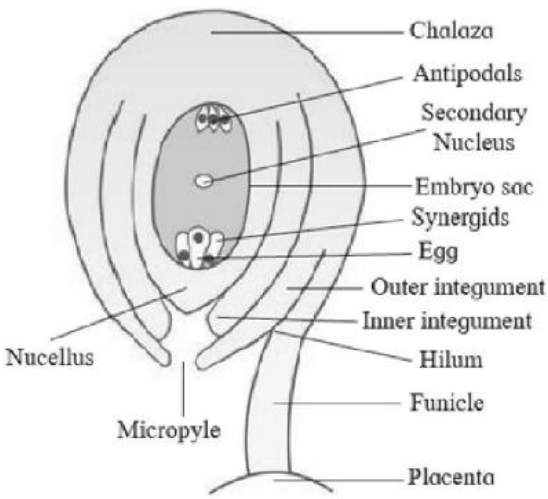
v. **Herkogamy :** It is a mechanical device to prevent self-pollination in a bisexual flower.
on plants, natural physical barrier is present between two sex organs and avoid contact of pollen with stigma of same flower, in e.g. Calotropis, pentagular stigma is positioned above the level of anothers (pollinia).

vi. **Self-incompatibility (self-sterility):** This is a genetic mechanism due to which the germination of pollen on stigma of the same flower is inhibited, e.g. Tobacco, Thea

SECTION D

Attempt Any Three Questions **12M**

Q.27 Structure of anatropous ovule: **4M**



Anatropous Ovule

i. **Anatropous ovule is the most common type of ovule in angiosperms.**
It consists of the following parts:

ii. **Funiculus/Stalk/Funicle:** Each ovule develops inside the ovary. Ovule is attached to the placenta by a small stalk called funiculus.

iii. **Hilum:** The point of attachment of the funiculus to the main body of the ovule is known as the hilum.

iv. **Nucellus:** The ovule consists of central parenchymatous tissue called nucellus.

v. **Integuments:** Nucellus is usually surrounded by two protective coverings called integuments viz. outer and inner integument.

vi. **Micropyle:** A _____ at the apex of the ovale is called the micropyle. Its anatropous ovule, micropyle is directed downwards and is present adjacent to the funiculus (funicle).

vii. **Chalaza:** Chalaza is the base of the ovule directly opposite to micropyle.

viii. **Embryo sac:** The embryo sac (female gametophyte) is an oval multicellular structure embedded in the nucellus.

Q.28 Contraceptive methods are of two main types i.e. temporary and permanent. **4M**

i. **Temporary methods:**

a. **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 the safe

period for sexual intercourse.
This method is based on the fact that ovulation occurs on the l4th day of menstrual cycle.
Drawback: High rate of failure.

b. **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.

c. **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.
Thetefore, as long as the mother breastfeeds the child fully, chances of conception are almost neg1igible.
Drawbacks: High chances of failure

d. **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.

e. **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 present conception.
It is a simple and effective method and has no side effects.
Condoms should be properly discarded after every use.
Condom is also a safeguard against STDs and AIDS.
eg.”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-uterjne devices (IUDs):** These clinical devices arc plastic at metal objects. A doctor or trained nurse places the IUDs tnto the uterus.
These devices include 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 acts 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 longer period,

Drawbacks: Spontaneous expulsion, occasional haemorrhage and chances of infection arc the drawbacks of IUDs.

f. 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.

g. 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 pil1s.

They prevent pregnancy for 3-4 years.

ii. Permanent Methods:

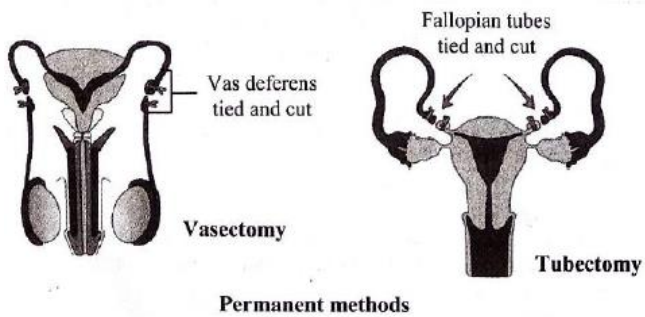
The permanent birth control method in men is called vasectomy and in women it is called tubectomy.

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.



Permanent methods

Q.29 The steps involved in gene cloning are as follows: **4M**

i. Isolation of DNA (gene) from the donor organism:

a. The desire gene to be cloned is obtained from the source organism (donor).
b. Initially the cells of the donor organism are sheared with the blender and treated with suitable detergent.
c. Genetic material from the donor is isolated and purified using several techniques.
d. Isolated DNA can be spooled on to a glass rod.

ii. Cutting of desired gene:

a. Isolated purified DNA is then cleaved by using restriction enzymes i.e.

restriction endonucleases.

b. These enzymes cleave DNA at restriction sites and break the DNA into fragments.

c. There are several types of restriction endonucleases.

d. Cleaved DNA Fragments have cohesive, sticky, staggered ends or blunt ends.

e. From cleaved DNA Fragments, a fragment containing desired gene is isolated and selected for cloning. This is now called foreign DNA or passenger DNA.

f. A desired gene can also be obtained directly from genomic library or cDNA library.

iii. Insertion of desired foreign gene into a cloning vector (vehicle DNA):

a. The foreign DNA or passenger DNA is now inserted into a cloning vector or vehicle DNA.

b. The most commonly used cloning vectors are plasmids of bacteria and the bacteriophage viruses like lambda phage and M13.

c. The most commonly used plasmid is pBR322.

d. Plasmids are isolated from the vector organisms i.e. bacterium.

e. By using same restriction enzyme (which is used in the isolation of the desired gene from the donor), plasmid i.e. vector DNA is cleaved.

f. Now by using enzyme DNA ligase, foreign DNA is inserted/ integrated into the vector DNA.

g. The combination of vector DNA and foreign DNA is now called Recombinant DNA or Chimeric DNA and the technology is referred to as rDNA technology.

iv. Transfer of rDNA into suitable competent host or cloning organism:

a. Finally the recombinant DNA is transferred for expression into a competent host cell which is usually a bacterium.

b. Host cell takes up naked rDNA by process of 'transformation' and incorporates into its own chromosomal DNA which finally expresses the trait controlled by passenger DNA.

c. The transfer of rDNA into a bacterial cell is assisted by divalent Ca^{++}.

d. The cloning organisms used in plant biotechnology are E. coil and Agrobacterium tumefaciens.

e. The hosi/competent cell which has taken up rDNA is now called transformed cell.

f. Foreign DNA can also be transferred directly into the naked cell or protoplast of the competent host cell, without using vector.

g. This is done by using techniques like electroporation, microinjection, lipofection, shot gun, ultrasonification, biolistic method, etc. But in plant biotechnology the transformation is through Ti plasmids of A. tumefaciens.

v. Selection of the transformed host cell:

a. The transformation process generates a mixed population of transformed (recombinant) and nontransformed (non-recombinant) host cells.

b. For isolation of recombinant cell from non-recombinant cell, marker gene of plasmid vector is employed.

For example, pBR322 plasmid vector contains different marker gene (Ampicillin resistant gene and Tetracycline resistant gene).

d. When Psti restriction enzyme is used, it knocks out Ampicillin resistant gene

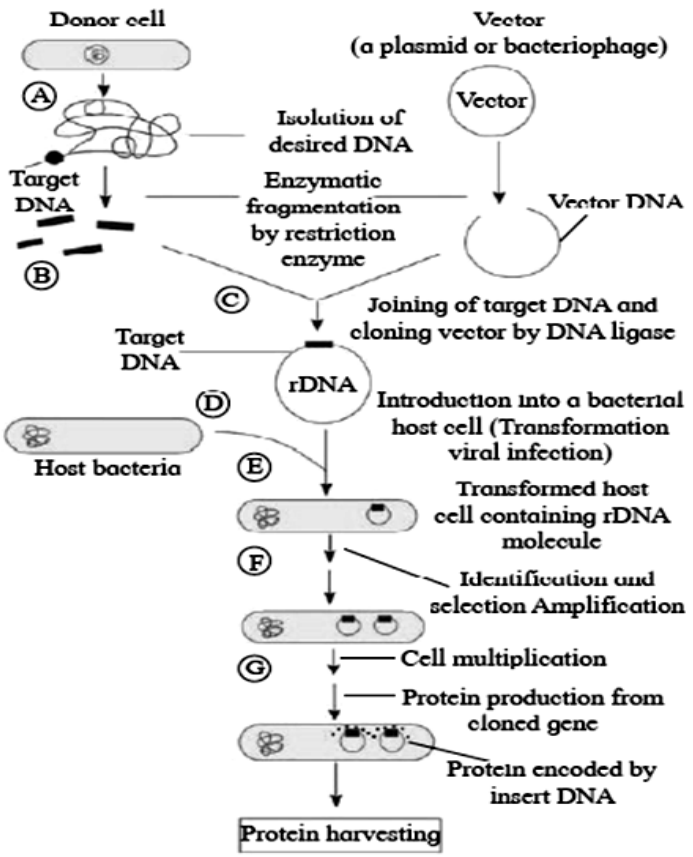
from the plasmid, so that the recombinant cell becomes sensitive to Ampicillin.

vi. Multiplication of transformed host cell:

a. Once transformed, host cells are separated by the screening process.
b. In this step the transformed host cells are introduced into fresh culture media.
c. At this stage the host cells multiply along with the replication of the recombinant DNA carried by them.

vii. Expression of the gene to obtain the desired product:

a. The next step involves the production of desired products like alcohol, enzymes, antibiotics, etc.
b. Finally the desired product is separated and purified through downstream processing using suitable bioreactor.



Outline of the process of recombinant DNA technology

Q.30 Diencephalon contains the epithalamus, thalamus and hypothalamus 4M

i. Epithalamus: It is the thin non-nervous roof of the diencephalon. It is fused anteriorly with the pia mater to form the anterior choroid plexus.
It is connected to pineal gland through a pineal stalk from its dorsal wall.

ii. Thalamus: It is formed by lateral thick walls of diencephalon. Thalami mainly contain grey matter. The habenculor commissure connects two thalami.
Different parts of the brain are interconnected by the RAS (Reticular Activating System) through the thalami. It is called relay centre as it transmits all sensory impulses except those of olfactory (smell) to the cerebrum. The narrow cavity of diencephalon is called 3rd ventricle or diocoel. It connects anteriorly to the two lateral ventricles by a single opening called Foramen of Monro and posteriorly

to the 4th ventricle or metacoel through a narrow duct of Sylvius or iter.

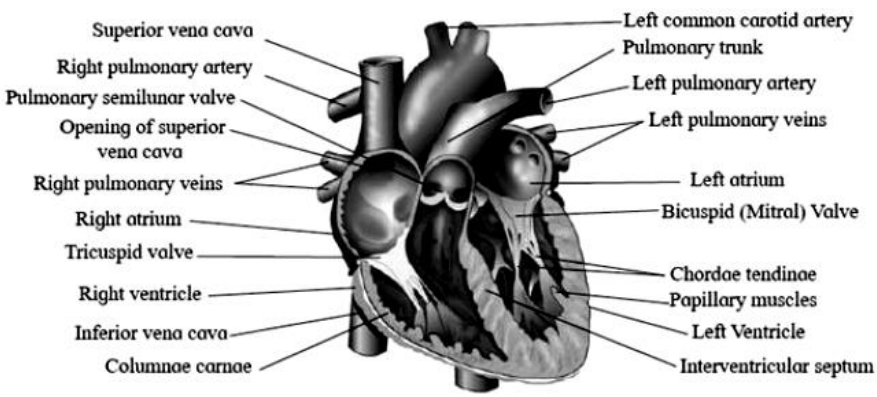
iii. Hypothalamus: It is ectodermal in origin. It forms the floor of the diencephalon.

It is richly supplied with blood vessels (Hypothalamo-hypophyseal portal vein) and helps in feedback mechanism for hormonal control. It maintains homeostasis, internal equilibrium of the body and involuntary behaviour control The hypothalamus also contains hypothalamic nuclei in its white matter with neuro - secretory cells involved in the production of hormones. The hypothalamus is a link between the nervous and the endocrine system. A complex neuronal circuit called the limbic system is formed by the hypothalamus, amygdala, parts of epithalamus and thalamus, hippocampus and other areas. It appears to be responsible for emotional reactions, motivational drives and memory. The floor of the hypothalamus continues as a downward projection called hypophyseal stalk or infundibulum which connects it to the hypophysis (pituitary gland) both physically and functionally by secretion of neurotransmitters. The inferior surface of hypothalamus also bears the optic chiasma (crossing of the two optic nerves) and a pair of mammillary bodies (unique to mammalian brain and responsible for recollective memory).

Functions of hypothalamus:

a. It regulates heart rate, respiration, blood pressure (B.P.), body temperature, water and electrolyte balance.
b. 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.
c. Major function of hypothalamus is maintaining homeostasis.
d. It controls the secretory activity of pituitary gland by releasing and inhibiting hormones.

Q.31 i. **4M**



Internal structure of human heart

a. Atria:

1. These are the thin-walled receiving chambers of heart. They are separated from each other by interauricular septum. Inter auricular septum has an oval depression called fossa ovalis. It is a remnant of the embryonic aperture called foramen ovalis.
2. Superior vena cava (precaval), inferior vena cava (postcaval) and coronary sinus open into the right atrium.

3. The opening of the postcaval is guarded by a Eustachian valve while the Thebesian valve guards the opening of coronary sinus into right atrium.
4. Four pulmonary veins open into the left atrium. These openings are without valves.
5. Both the atria open into the ventricles of their respective sides by atrioventricular apertures. These openings are guarded by cuspid valves.
6. The tricuspid valve is present in the right AV aperture and bicuspid valve (mitral valve) is present in the left AV aperture. All these heart valves help in aintaining a unidirectional flow of blood. They also avoid back flow of blood.

b. **Ventricles:** These are inferior, thick-walled pumping chambers of the heart. The right and left ventricles are separated by inter ventricular septum.
The wall of the left ventricle is more muscular and about three -times thicker than the right ventricle.
The inner surface of the ventricles shows several ridges called columnae carneae or trabeculae carneae which divide the lumen of ventricle into small pockets or fissures.
The lumen of ventricles also shows inelastic fibers called chordae tendineae. These attach the bicuspid and tricuspid valves to the ventricular wall (papillary muscles) and regulate their opening and closing.
The right ventricle opens into the pulmonary aorta and left ventricle opens into the aorta. These openings are guarded by three semilunar valves each. These valves prevent the backward flow of blood into the ventricles.

ii. The bicuspid and tricuspid valves are connected to chordae tendineae which in turn are, connected to the papillary muscles present on ventricular wall. Chordae tendineae and papillary muscles regulate opening and closing of valves.