Biology

Model Set - 3

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 number of meiotic and mitotic divisions necessary for development of female gametophyte in angiosperms is _____.

1. 1 meiosis and 2 mitosis
2. 1 mitosis and 3 meiosis
3. 1 meiosis and 1 mitosis
4. 1 meiosis and 3 mitosis.

1.ii _____ is an example of helobial endosperm.

1. Adoxa
2. coconut
3. Asphodelus
4. sunflower

1.iii The average period of pregnancy in human lasts for _____ days of pregnancy.

1. 280
2. 270

3. 266
4. 290

1.iv The proportion of an allele in the gene pool to the total number of alleles at a given locus is called _____.

1. gene pool
2. gene frequency
3. gene flow
4. genetic drift

1.v Any random fluctuation in allele frequency, occurring in the natural population by pure chance is called _____.

1. gene pool
2. gene mutation
3. genetic recombination
4. genetic drift

1.vi Root hair is _____ extension of epiblema cells.

1. Cytoplasmic
2. Protoplasmic
3. Nucleoplasmic
4. Cellulosic

1.vii In the zone of absorption, epidermal cells form unicellular hair-like extensions called _____.

1. Epiblema cells
2. Roots
3. Root hairs
4. Velamen tissues

1.viii Which of the following has thickest wall?

1. Right auricle
2. Right ventricle
3. Left auricle
4. Left ventricle

1.ix In transgenic crop substance provitamin A is obtained in _____.

1. rice
2. tomato
3. canola
4. canola

1.x Select the odd example with respect to types of conservation strategies.

1. Pawra tribals in Satpuda have protected varieties of corn with different coloured kernels.

2. Kanha forest as tiger reserve.
3. Crocodile bank of Chennai
4. Sacred groves

Q. 2 | Answer the following:

2.i Which is the most common type of endosperm in angiospermic families?

Ans. Nuclear type is the most common type of endosperm found in angiospermic families.

2.ii Identify the permanent birth control method in given diagram.

Ans. The permanent birth control method in the given diagram is called as tubectomy.

2.iii Identify the IUD in the given diagram.

Ans. The IUD in the given diagram is Lippes Loop.

2.iv Whose fossils were discovered at the site of Shivalik hills, India?

Ans. The fossils of Ramapithecus were discovered at the site of Shivalik hills, India.

2.v What is meant by Hygroscopic water?

Ans. Fine soil particles imbibe/absorb water and hold it very tightly. This is called 'hygroscopic water'.

2.vi Why is ABA known as antitranspirant?

Ans. ABA can cause efflux of K+ ions from the guard cells and result in closure of stomata. So, it is known as an anti-transpirant.

2.vii Which Recombinant proteins is obtained for Hepatitis-B by r-DNA technology.

Ans. Hepatitis B is treated using Hepatitis B vaccine obtained by the application of r-DNA technology.

2.viii What is 'Climax community'?

Ans. A climax community is the final stage of ecological succession which remains stable as long as the environment remains unchanged

Q. 3 | Attempt any Eight:

Explain heterostyly and herkogamy with suitable example.

Ans.

i. **Heterostyly (heteromorphy):**
Plants like Primula (Primrose) produce two or three types of flowers in which stigmas and anthers are placed at different levels (heterostyly and heteroanthy). This prevents the pollens from reaching the stigma and pollinating it. In heteromorphic flowers, pollen grains produced from anther pollinate stigmas produced at the same level. Thus self-pollination is not possible in such cases.

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

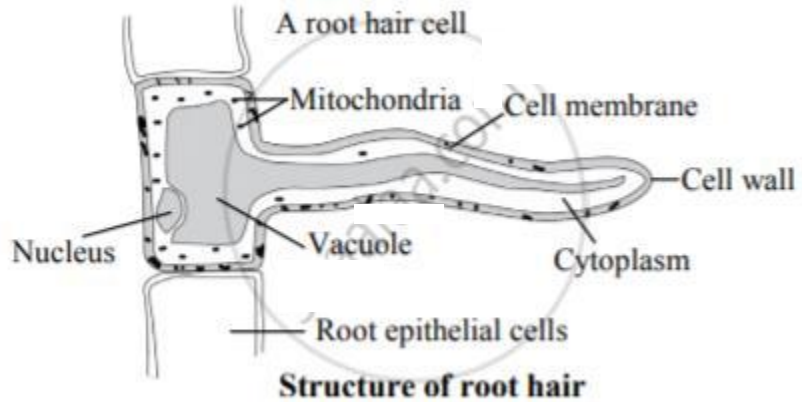
Q. 4 What is lactation? Which hormone is responsible for its regular secretion?

Ans.

i. Lactation is the process by which the mammary glands of the female start producing milk at the end of pregnancy.
ii. Prolactin is the hormone that is responsible for its regular secretion.

Q. 5 Draw a neat and labelled diagram of Root hair.

Ans.



Structure of root hair

Q. 6 Why water is called as 'Elixir of Life'?

Ans.

1. Water is in liquid form at room temperature and is the best solvent for most of the solutes.
2. In pure form, it is the inert inorganic compound with neutral pH. Due to this, water is the best transporting medium for dissolved minerals and food molecules.
3. It is the best aqueous medium for all biochemical reactions occurring in the cells.
4. It is an essential raw material for photosynthesis.
5. Water has high specific heat, high heat of vaporization, and high heat of fusion. Due to this, it acts as a thermal buffer.
6. Water molecules have good adhesive and cohesive forces of attraction.
7. Due to high surface tension and high adhesive and cohesive force, it can easily rise in the capillaries. This is why water is called as 'Elixir of Life'.

Q. 7 A gardener wants to give bushy appearance to plants in our college campus.

i. What should he do to achieve the same?
ii. Which property of phytohormones he must be aware of?

Ans. i. a. Pruning is done to remove apical dominance in plants.

b. When plants are decapitated, removal of apical bud results in growth of lateral buds which gives bushy appearance to plants.

c. Thus, pruning is done to encourage growth of more shoots with softer leaves.

ii. The gardener should be aware of the property of apical dominance.

Q. 8 Define intracellular transport and extracellular transport.

Ans.

i. Intracellular transport: In Parameocium, Amoeba, root hair cells of many plants and WBCs in animals, transportation of materials occurs within the cell due to the

streaming movement of the cytoplasm known as cyclosis. This is known as intracellular transport.

ii. Extracellular transport: In roundworms there are no blood vessels and the body fluid is moved around the viscera by contraction of body wall and muscles. This is extracellular transport.

Q. 9 Define Bohr effect and Haldane effect.

Ans.

i. Bohr effect: Bohr effect is the shift of oxyhaemoglobin dissociation curve due to change in partial pressure of CO2 in blood.

ii. Haldane effect: The amount of CO2 that can be transported in the blood is influenced by the percent saturation of haemoglobin with oxygen. The lower the amount of oxyhaemoglobin (Hb-O2), the higher the CO2 carrying capacity of the blood, this relationship is known as the Haldane effect.

Q. 10 Define Hamburger's phenomenon. Add a note on it.

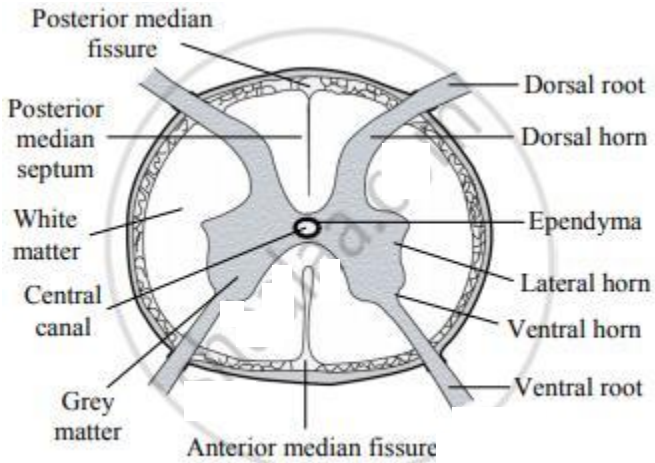
Ans. Hamburger's phenomenon or chloride shift refers to diffusion of chloride ions into the RBCs tof maintain the ionic balance between the RBCs and the plasma.

The rate of formation of carbonic acid inside the RBC is very high as compared to its formation in the plasma. Carbonic acid being unstable almost immediately dissociates into HCO3 − and H+ in the presence of the enzyme carbonic anhydrase (CA) leading to accumulation of large amount of HCO3 − inside the RBCs.

CO2 + H2O →CA ← H2CO3 →CA ← H+ + HCO3 − It thus, moves out of the RBCs causing an imbalance of the charge inside the RBCs. To maintain the ionic balance between the RBCs and the plasma, Cl- diffuses into the RBCs.

Q.11 Sketch and label T.S of Spinal cord.

Ans.



T. S. of spinal cord

Q. 12 Which two hormones are responsible for the regulation of calcium and phosphorus in the blood?

Ans. Calcitonin and parathormone are responsible for regulation of calcium and phosphorous in the blood.

Q. 13 Give names of two organisations which provide most commonly used models of biogas plants.

Ans. KVIC and IARI provide the most commonly used models of biogas plants.

Q. 14 Write any two human disorders and to cure which recombinant proteins are produced?

Ans.

No	Human Disorders	Recombinant Protein
i.	Atherosclerosis	Platelet derived growth factor
ii.	Emphysema	α1- antitrypsin

Q. 15 | Attempt any Eight:

Explain any two contrivances or outbreeding devices for pollination.

Ans. Genetic diversity is an essential factor for evolution by natural selection. Continued self-pollination results in inbreeding depression. Thus, plants have developed many devices to encourage cross-pollination. The examples of outbreeding devices are as follows:

i. **Unisexuality:** In this, the plant bears either male or female flowers. It is also called 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:

   a. **Protandry:**
   In this type, anthers mature first, but the stigma of the same flower is not receptive at that time. e.g. in the disc florets of sunflower.

   b. **Protogyny:**
   In this type, the stigma of the carpel matures earlier than the 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 are placed at different levels (heterostyly and heteroanthy). This prevents the

pollens from reaching the stigma and pollinating it. In heteromorphic flowers, pollen grains produced from 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. In plants, a natural physical barrier is present between two sex organs and avoid contact of pollen with the stigma of the same flower, e.g. Calotropis, pentangular stigma is positioned above the level of anthers (pollinia).

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

Q.16 Explain any three methods that can be used to overcome infertility.

Ans. The infertile couples could be assisted to have child/children through certain special techniques commonly known as Assisted Reproductive Technologies (ART).

1. **IVF (In-vitro Fertilization):** It is a process of fertilization where an egg is combined with sperm outside the body in a test tube or glass plate to form a zygote under simulated conditions in the laboratory. The zygote or early embryos (with up to 8 blastomeres) could be then transferred into the fallopian tube for further development.
2. **ZIFT (Zygote Intrafallopian Transfer):**
   ZIFT is an infertility treatment used when there is a blockage in the fallopian tubes which prevents the fertilization of the egg by the sperm. In this method, the egg is removed from the woman's ovary. Fertilization of the egg with sperms is brought about outside the body under sterile conditions to form a zygote by the process called in vitro fertilization (IVF). The zygote is then transferred to the fallopian tube for further development.
3. **GIFT (Gamete Intrafallopian Transfer):**
   This method involves the transfer of an ovum collected from a donor into the fallopian tube of another female who can provide a suitable environment for its fertilization and development. GIFT was developed for the cases in which only the entrance to the oviducts or the upper segment of the oviducts in blocked. In this procedure, ova and sperms are directly injected into regions of the oviduct, where fertilization produces a blastocyst, which enters the uterus via the normal route. GIFT has a success rate of about 30 percent.
4. **ICSI (Intra Cytoplasmic Sperm Injection):**
   ICSI is an in vitro fertilization procedure in which a single sperm cell is injected directly into the cytoplasm of an ovum in the laboratory.
5. **Artificial Insemination (AI):**
   In some infertility cases, the male partner is unable to inseminate the female due to a very low sperm count. This problem can be solved by artificial insemination. In this technique, the sperms are collected from the male and artificially introduced into the cervix of the female, for the purpose of achieving a pregnancy through in vivo fertilization (inside the body).

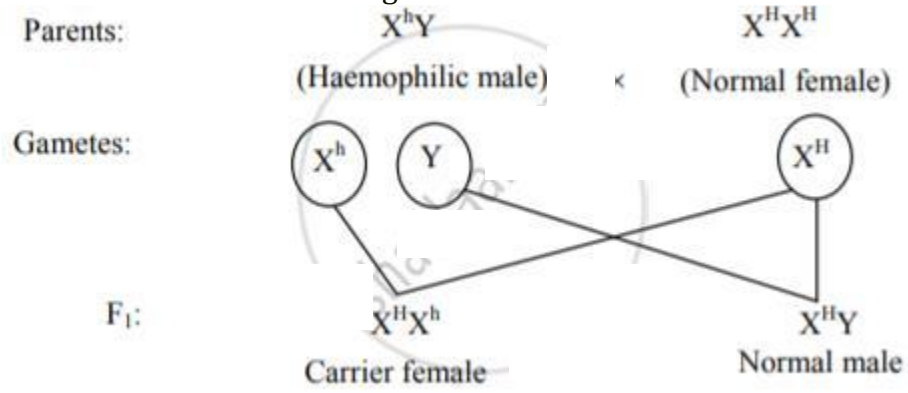
6. **IUI (Intra Uterine Insemination):** IUI resembles the procedure of artificial insemination, the only difference is that the sperms are introduced into the uterine cavity instead of the cervix.

Q. 17 Write a note on bleeder's disease and its inheritance with a suitable chart.

Ans. Haemophilia (Bleeder's disease):

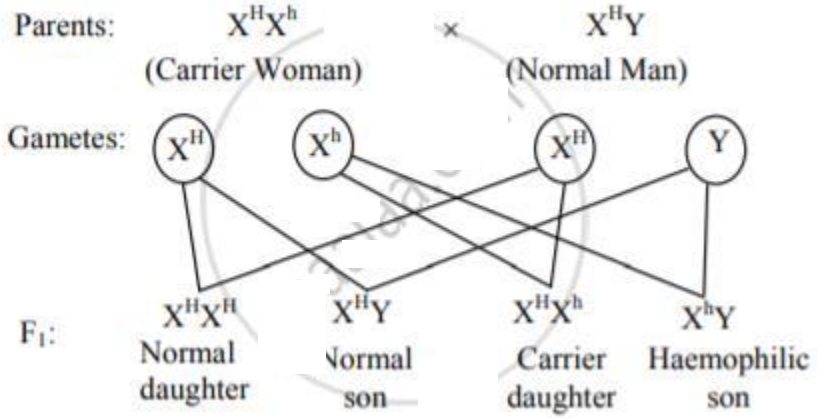
1. Haemophilia is an X-linked recessive disorder in which blood fails to clot or coagulates very slowly.
2. The genes for normal clotting are dominant over the recessive genes for haemophilia.
3. The person having a recessive gene for haemophilia is deficient in clotting factors (VIII or IX) in blood.
4. Even minor injuries cause continuous bleeding, hence haemophilia is also called bleeder's disease.
5. The recessive gene for haemophilia is located in a non-homologous region of the X chromosome.
6. As there is no corresponding allele on the Y chromosome to suppress its expression, so men suffer from this disease.
7. Women suffer only when both X chromosomes have recessive genes (alleles).

a. If a haemophilic male (Xh Y) marries a female with the normal clotting of blood (XHXH), then all the offsprings will show normal clotting of blood. The sons will have normal clotting of blood, but daughters will be carriers for the disease. The carriers have normal clotting of blood.



b. When a carrier woman (XHXh) marries a normal man (XHY), then all the daughters will have normal clotting of blood but half of them will be carriers for the disease. Half the sons will be haemophilic while the remaining will have normal clotting of

blood.



Q. 18 Give reasons for the development of Turner's syndrome and also mention its symptoms.

Ans. Turner Syndrome (X monosomy/XO females):

1. It is a sex chromosomal disorder caused due to non-disjunction of chromosomes during gamete formation.
2. Individual born with Turner syndrome has 44 autosomes with XO.
3. They are phenotypically female. They have short stature (height) and webbed neck, lower posterior hair line, broad shield-shaped chest, poorly developed ovaries and breast, and low intelligence.

Q. 19 Short Answer Question:

Write a note on Human genome project (HGP).

Ans. The human genome project was initiated in 1990 under the International administration of the Human Genome Organization (HUGO).
This project was coordinated by the US Department of Energy and the National Institute of health. Additional contributors included universities across the United States and international partners in the United Kingdom, France, Germany, Japan and China.
The Human Genome Project was completed in 2003.

Following are the main aims of the human genome project:

1. Mapping the entire human genome at the level of nucleotide sequences.

2. To store the information collected from the project in databases.

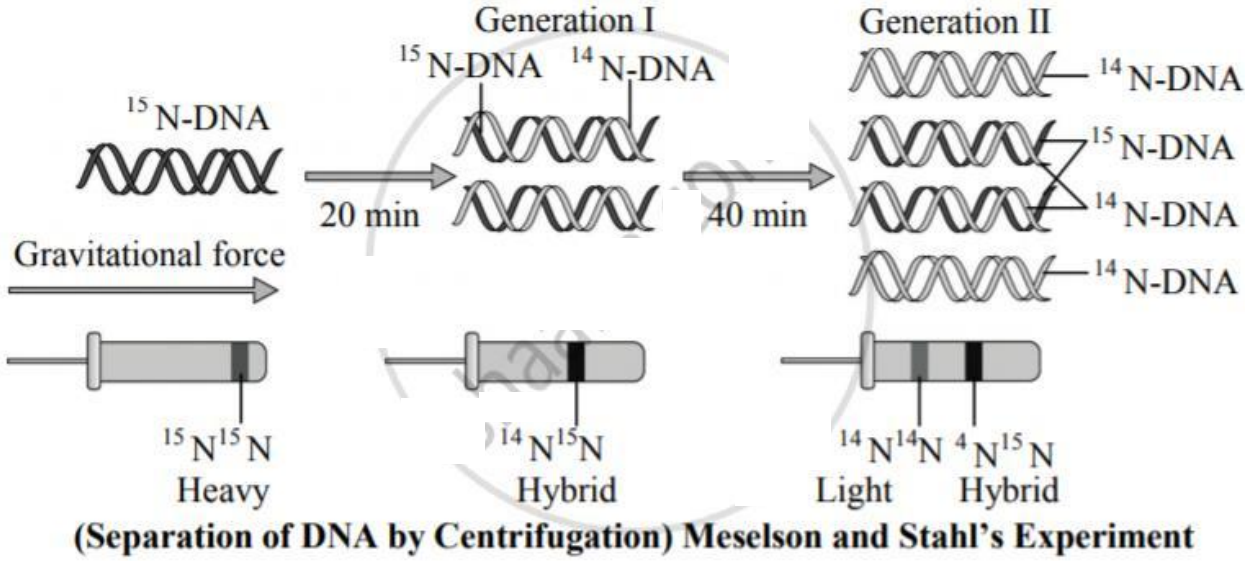
3. To develop tools and techniques for analysis of the data.

4. Transfer of the related technologies to the private sectors, such as industries.

5. Taking care of the legal, ethical and social issues which may arise from the project

Q. 20 Draw a neat and labelled diagram explaining Meselson's and Stahl's experiment.

Ans.



(Separation of DNA by Centrifugation) Meselson and Stahl's Experiment

Q. 21 Explain Geographical Isolation

Ans. Geographical isolation (Physical isolation):

1. It occurs when an original population is divided into two or more groups by geographical barriers such as rivers, oceans, mountains, glaciers, etc.
2. These barriers prevent interbreeding between isolated groups. The separated groups are exposed to different kinds of environmental factors and they acquired new traits by mutations.
3. The separated populations develop distinct gene pools and do not interbreed. Thus, new species have been formed by geographical isolation. e.g. Darwin's Finches.

Q.22 Define hypertension. Explain coronary artery disease and angina pectoris.

Ans. Hypertension: Persistently raised blood pressure higher than the normal is called hypertension.

i. Coronary artery disease:

a. Coronary Artery Disease (CAD) is also known as atherosclerosis.
b. In this, calcium, fat cholesterol and fibrous tissues get deposited in blood vessels supplying blood to the heart muscles making the lumen narrow.

ii. Angina pectoris:

a. It is the pain in the chest resulting from a reduction in the blood supply to the cardiac muscles because of atherosclerosis or arteriosclerosis.
b. It is characterized by severe pain and heaviness in the chest. The pain may spread to the neck, lower jaw, left arm and left shoulder. The pain usually results from

exertion, when there is more demand of oxygen by the heart, but the supply does not meet the requirement.

Q. 23 Name three Mixed cranial nerves along with their numbers.

Ans. The mixed cranial nerves are as follows:

i. V - Trigeminal
ii. VII-Facial
iii. IX - Glossopharyngeal

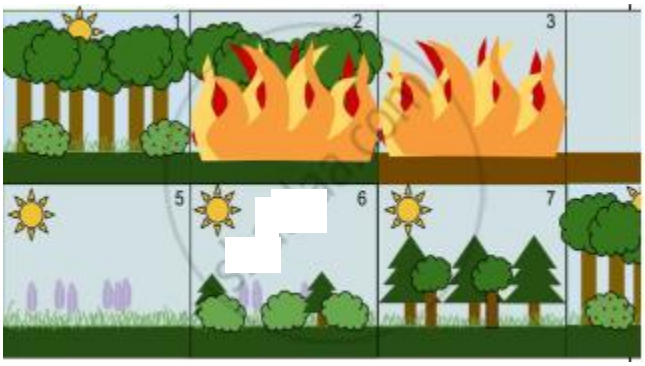
Q. 24 What is GM plant? Write its different advantages.

Ans. Definition: Transgenic plants are those plants which have their DNA manipulated to possess and express foreign gene.

Advantages of genetically modified/transgenic plants:

i. Insect pest resistance
ii. Transgenic plants act as factories/bioreactors

Q. 25 Explain the following sequence of succession after a forest fire.



Ans. The sequence of stages in a forest ecosystem (secondary succession) after fire is as follows:

Forest → Forest fire → Severe forest fire → Total nudation of forest land → Terrestrial plants → Shrubs → Woodland Stage → Forest Stage The forest fire leaves behind an empty but not destroyed soil (Nudation), over which secondary succession begins.

i. **Terrestrial plant stage:** Grasses and other herbaceous plants grow back first.
ii. **Shrub stage:** Small bushes and trees begin to colonize the area
iii. **Woodland stage:** Fast-growing evergreen trees grow tall, while shadetolerant trees develop understorey.

Q. 26 The reasons for conservation of biodiversity can be classified into three categories. Name them and describe each in brief.

Ans. The reasons for conservation of biodiversity can be classified into three categories:

i. Narrowly utilitarian reasons:

a. Since ancient times, humans are reaping material benefits from biodiversity. This includes, deriving resources for basic needs such as food, clothes, shelter or industrial products like resins, tannins, perfume base, etc. or aesthetic use like ornaments and artefacts.
b. Medicinal use of plants and animals is another major factor. It shares 25% of global medicine market. Around 25000 species are put to use by tribals worldwide as traditional medicines.

ii. Broadly utilitarian reasons:

a. Animals play a crucial role in pollination and seed dispersal.
b. Amazon forest is estimated to produce 20% of total oxygen of Earth's atmosphere. We need to consider recreational use of biodiversity.

iv. **Ethical reasons:** We have no right to destroy the diversity simply because we share the earth with them. All living beings have equal right to survive irrespective of their known or prospective economic use.

Q. 27 | Attempt any Three:

Name the phytohormone related with the given phenomenon

i. Apical dominance
ii. Bolting of Cabbage
iii. Artificial ripening of fruit
iv. Acts as Anti-transpirant by closing stomata

Ans.

i. Auxin
ii. Gibberellins
iii. Ethylene
iv. Abscisic acid

Q. 28 Describe any four hormones secreted by Adenohypophysis.

Ans. i). Somatotropic Hormone (STH) / Somatotropin / Growth Hormone (GH): Secretion of GH is high till puberty later its secretion becomes low. However, it is continuously secreted throughout life for repair and replacement of body tissue or cells.

Functions:

a. It stimulates growth of the body and development of all tissues.
b. It accelerates protein synthesis and cell division.
c. It stimulates the release of growth hormone.

ii). Thyroid Stimulating Hormone (TSH) / Thyrotropin:

Function: It stimulates thyroid gland to produce hormone thyroxine.

iii). Adrenocorticotropic Hormone (ACTH) / Adrenocorticotropin:

Functions:

i. It stimulates adrenal cortex to produce its hormones.
ii. It maintains functioning of adrenal cortex.

iv). Prolactin / Luteotropin/ Mammotropin: Secretion of this hormone is regulated by PIF (Prolactin inhibiting factor) of hypothalamus.

Functions:

a. Activates the growth of mammary glands during pregnancy (mammotropin).
b. Stimulates milk production and secretion of milk (lactogenic) by mammary gland after child birth.

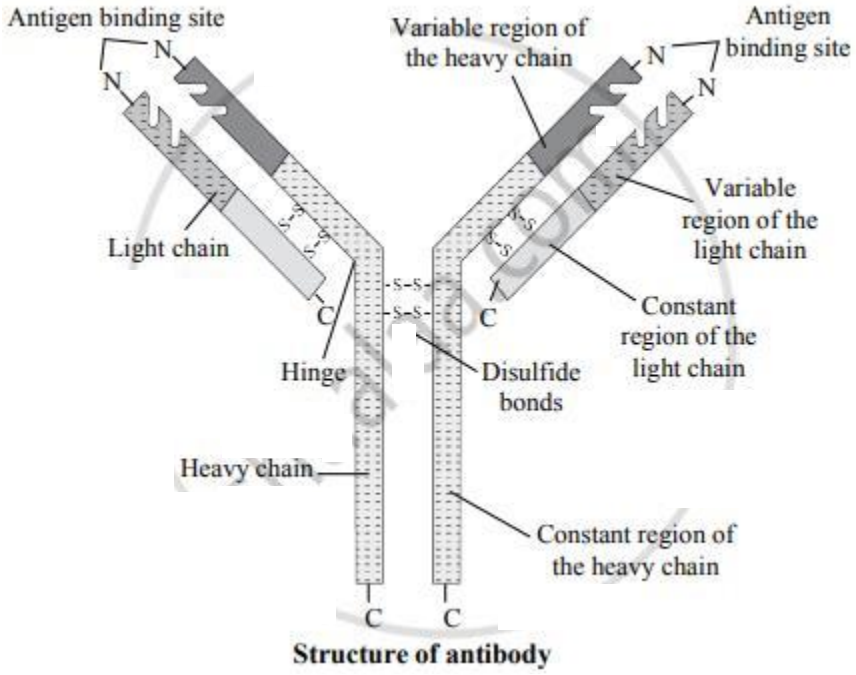
Q. 29. A Enlist the four types of T- lymphocytes, responsible for immune response of our body.

Ans. A The four types of T- lymphocytes, responsible for immune response of our body are as followsi.

i. Helper T-cells
ii. Killer T-cells or Cytotoxic T-cells
iii. Suppressor T-cells iv. Memory T-cells

Q. 29. B Sketch and label – Structure of Antibody

Ans. B



Structure of antibody

Q. 30 Explain the process of sewage water treatment before it can be discharged into natural water bodies.

Ans. The sewage treatment plants process is carried out in two ways:

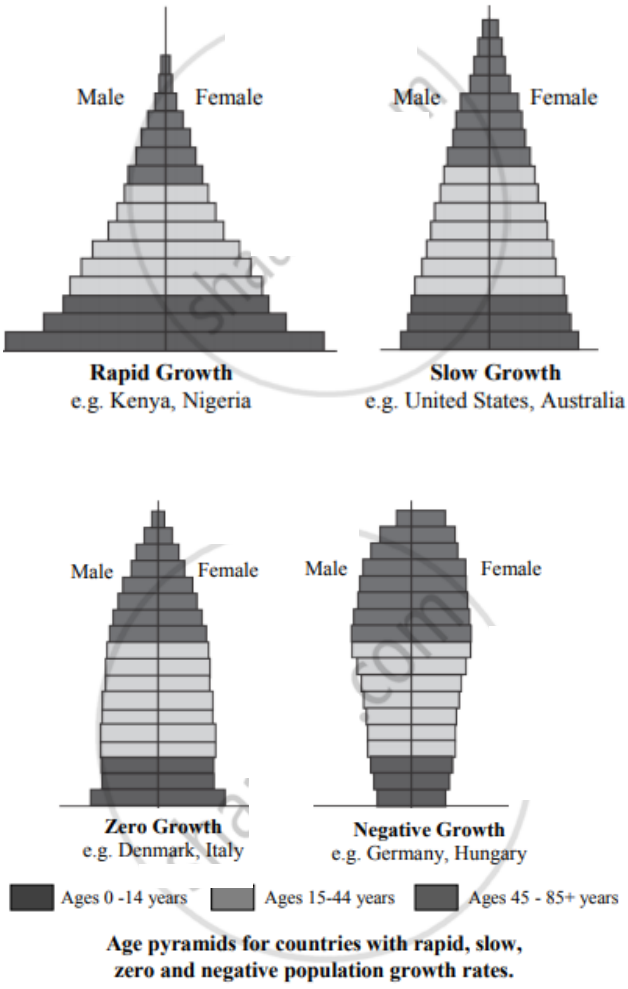
a. **Primary treatment:** It involves the physical removal of particles from sewage through filtration and sedimentation. Floating debris is removed by filtration and grit is removed by sedimentation. Thus, all solids which settle from the primary sludge and the supernatant forms the effluent.
b. **Secondary treatment:** The effluent from primary treatment is passed to aeration tanks where the air is pumped into it. This allows the growth of useful aerobic microbes into flocs (masses of bacteria associated with fungal filaments) and microbes consume the major part of the organic matter in the effluent. This reduces the BOD (biological oxygen demand) of the effluent. The effluent is then passed into the settling tank where bacterial flocs are allowed to sediment. This sediment is called activated sludge. The small portion of this activated sludge is again passed to the aeration tank to serve as inocula. The remaining major part of this sludge is pumped into large anaerobic sludge digesters. Here, anaerobic bacteria digest bacteria and fungi in the sludge. During this digestion, bacteria produce a mixture of gases such as methane, H_2S, and CO_2. This treatment is essential as the sewage or municipal waste discharged into rivers, streams and other water bodies contains human excreta, organic wastes, and several pathogenic microbes.

Q. 31 Define population growth. Explain different types of age pyramids.

Ans. Definition: The increase in the size of a population or increase in number of individuals is known as population growth. When resources in the habitat are unlimited, population show exponential growth. When resources in the habitat are limited, it leads to competition between individuals for limited resources. This type of population growth is called logistic growth

Age distribution and Age pyramids:

1. A population consists of individuals with different ages. The entire population is divided into three age groups - prereproductive (0-14 years), reproductive (age 15-44 years), post reproductive (45-85+years)The relative proportion of individuals of various age groups in the population is referred to as age structure of the population.
2. If the age distribution (per cent individuals of a given age or age group) is plotted for the population, the resulting structure is called as age pyramid.



Age pyramids for countries with rapid, slow, zero and negative population growth rates.