Maharastra Board | Class 12 Biology

Previous 3-Year Questions with Detailed Solutions (2022-2024)

93 Questions

of Biology with Detailed Solution

CAREERS360

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About This Book

Welcome to the comprehensive collection of Maharashtra Board Class 12 Biology Previous 3-Year Questions with Detailed Solutions (2022-2024). This ebook is designed to be your go-to resource for mastering the Class 12 Biology syllabus and excelling in your exams.

Inside This Ebook:

- **Elaborate Solutions:** Benefit from precise, step-by-step solutions to each question, crafted to simplify complex concepts and enhance your understanding of biological principles.
- **Strategic Exam Preparation:** Utilize this ebook as a strategic tool for revision and practice, gaining familiarity with the exam pattern and the variety of questions typically encountered.
- **Expertly Crafted Content:** All solutions are prepared by experienced faculty, ensuring they are accurate, comprehensive, and easy to understand.

This ebook is more than just a collection of questions and answers; it's a complete study guide designed to support you through your academic journey. Whether you're aiming to reinforce your understanding, practice rigorously, or get a clear grasp of intricate concepts, this resource is tailored to meet your needs and help you achieve excellence in your Class 12 Biology exams.

Happy learning!

Warm regards,
Team Careers360

Maharashtra Board Class 12 Biology
Solutions - 2024

SECTION-A

Q. 1. Select the correct alternatives and write the answers :
(i) Identify the growth hormone in plants which causes inhibitory effect.
(a) Cytokinins
(b) Abscissic acid
(c) Gibberellin
(d) Ethylene

Solution:

The growth hormone in plants which causes an inhibitory effect is identified as Abscisic acid.

Hence the answer is option (b).

(ii) Which one of the following is not a part of lac operon?
1. Promoter
2. Regulator
3. Inducer
4. Operator

Solution:

The component which is not a part of the lac operon is the Inducer.

Hence the answer is option (c) .

(iii) In absence of fertilization, corpus luteum degenerates into _____.
1. Tunica albugenia
2. Membrana granulosa
3. Zona pellucida
4. Corpus albicans

Solution: In the absence of fertilization, the corpus luteum degenerates into the corpus albicans.

(iv) Which of the following divides nasal cavity?
1. Hyaline cartilage
2. Mesethmoid cartilage
3. Ligamentum arteriosum
4. Laryngopharynx

Solution: The structure that divides the nasal cavity is the Mesethmoid cartilage.

(v) Which of the following is caused by unsterilized needle?
(a) Elephantiasis
(b) AIDS
(c) Malaria
(d) Dengue

Solution: The disease caused by unsterilized needles is AIDS.

(vi) Recognition sequence of restriction enzymes are generally _____ nucleotides long.
(a) 2 to 4
(b) 4 to 8
(c) 8 to 10
(d) 14 to 18

Solution: The recognition sequence of restriction enzymes is generally 4 to 8 nucleotides long.

(vii) Which of the following types require pollinator but result is genetically similar to autogamy?
(a) Geitonogamy
(b) Xenogamy
(c) Apogamy
(d) Cleistogamy

Solution: The type that requires a pollinator but results in genetically similar offspring to autogamy is Geitonogamy.

(viii) Which one of the following does not evolve further?

(a) Climax community

(b) Primary Succession

(c) Pioneer Species

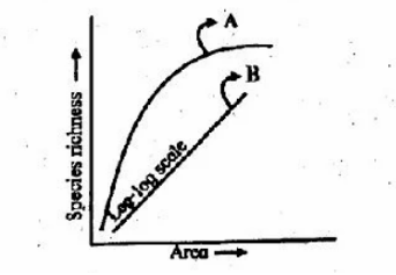
(d) Seral Community

Solution: The community that does not evolve further is the Climax community.

(ix) Identify the appropriate term for the number of births under ideal conditions :
(a) Absolute mortality
(b) Realized natality
(c) Realized mortality
(d) Absolute natality

Solution: The appropriate term for the number of births under ideal conditions is Absolute natality.

(x) Observe the graph and select correct option :



(a) Line ' A ' represents S-CA

(b) Line ' B ' represents $\log C = \log A + Z \log S$

(c) Line A represents $\mathrm{S} = \mathrm{CA}^{\mathrm{Z}}$

(d) Line B represents $\log \mathrm{S} = \log \mathrm{Z} + \mathrm{C} \log \mathrm{A}$

Solution: Observing the graph, the correct option is that Line A represents $S = CA^Z$.

Q. 2. Answer the following questions :

(i) What are vestigeal organs?

Solution: Vestigial organs are anatomical structures that have lost all or most of their original function in the course of evolution. Examples include the appendix in humans and the hind limb bones in whales.

(ii) Expand the term ZIFT.
Solution: The term ZIFT stands for Zygote Intrafallopian Transfer.

(iii) Give the name of endocrine gland which is prominent at birth but gets gradually atrophied in adult stage
Solution: The endocrine gland that is prominent at birth but gets gradually atrophied in the adult stage is the thymus gland.

(iv) What is the full form of IAA?
Solution: The full form of IAA is Indole-3-Acetic Acid.

(v) Give the name of microbial source of antibiotic chloromycetin.
Solution: The microbial source of the antibiotic chloromycetin is Streptomyces venezuelae.

(vi) Which cells of islets of Langerhans produce a hormone insulin?

Solution: The cells of the islets of Langerhans that produce the hormone insulin are the beta cells (β-cells).

(vii) How many meiotic divisions are required for the formation of 300 seeds in angiosperm?
Solution: The number of meiotic divisions required for the formation of 300 seeds in angiosperms is 300, as each seed is formed from one meiotic division.

(viii) Explain the term Emigration.

Solution: Emigration is the process of individuals moving out of a population or area, thereby decreasing the population size in that specific region.

SECTION-B

Attempt any EIGHT of the following questions :

Q. 3. What are the reasons for the success of Mendel?

Solution:

Reasons for the Success of Mendel:

Mendel selected pea plants, which have easily distinguishable traits.
He focused on one or two traits at a time and used statistical analysis.
Mendel conducted controlled breeding experiments and used large sample sizes.
He applied mathematical models to predict the inheritance patterns.
Mendel documented and meticulously recorded all his observations.

Q. 4. Arrange the following steps of DNA fingerprinting in correct sequence :

(a) Gel electrophoresis

(b) Isolation of DNA

(c) Southern blotting

(d) Restriction digestion

Solution: Correct Sequence of Steps for DNA Fingerprinting:

a. Isolation of DNA
b. Restriction digestion
c. Gel electrophoresis
d. Southern blotting

Q. 5. Distinguish between human sperm and ovum.

Solution:

Characteristic	Sperm	Ovum
Size	Approximately 50-60 micrometers long	Approximately 100-120 micrometers in diameter
Structure	Streamlined: head, midpiece, tail	Spherical with a large amount of cytoplasm
Nucleus Location	Located in the head	Located centrally
Genetic Material	23 chromosomes (haploid)	23 chromosomes (haploid)

Mobility	Motile, moves with tail (flagellum)	Non-motile, moves passively
Energy Source	Mitochondria in the midpiece	Cytoplasmic reserves
Number Produced	Millions produced daily	Typically one released per menstrual cycle
Lifespan	2-5 days within the female reproductive tract	12-24 hours after ovulation
Function	To deliver genetic material to the ovum	To provide genetic material and initial nutrients for embryo
Production Site	Testes	Ovaries

Q6. Enlist the uses of gene therapy.

Solution:

- Replace missing or defective genes.
- Deliver genes that speed up the destruction of cancer cells.
- Supply genes that cause cancer cells to revert back to normal cells.
- Deliver bacterial or viral genes as a form of vaccination;
- Deliver DNA to antigen expression and generation of immune response.
- Supply of gene for impairing viral replication.

Q. 7. Define the following terms :

(a) Gene flow

Solution: It is the elimination or addition of the genes of certain characters when some animals in population migrate or dies or immigrate. It changes the gene frequency of remaining population. (Change in frequency of genes in a gene pool is called genetic flow)

(b) Chromosomal aberrations

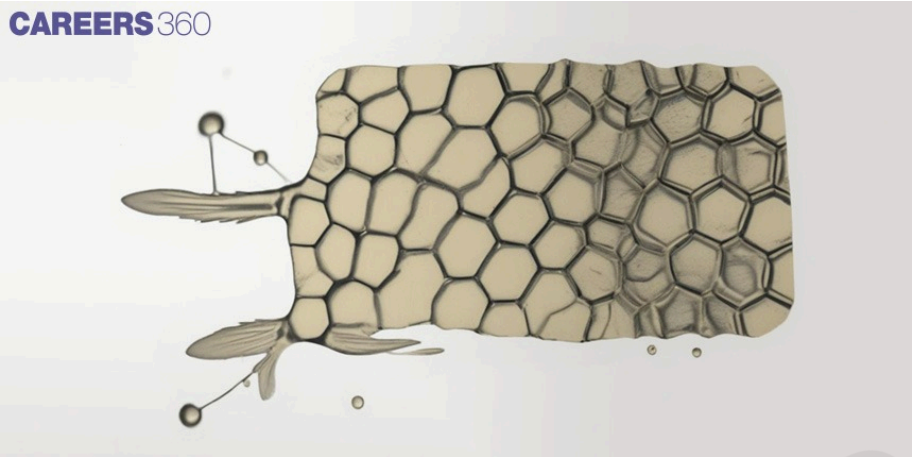
Solution:

- Chromosomal aberrations are alterations in chromosome structure or number that cause variations in gene sequence or order.
- These changes can include deletions (loss of chromosome segments), duplications (repetition of segments), inversions (segments reattached in an inverted orientation), and translocations (segments relocated to non-homologous chromosomes).
- Changes to genes can have several biological repercussions.

Q. 8. What are the significances of double fertilization?
Solution: Significance of double fertilization:
i. It is a unique feature of angiosperms.
ii. It ensures that the parent plant invests a seed with a food store, only if the egg is fertilized.
iii. The diploid zygote develops into an embryo which consequently develops into a new plant.
iv. The triploid PEN develops into nutritive endosperm tissue.

v. It restores the diploid condition by the fusion of the haploid male gamete with the haploid female gamete (i.e. through syngamy).
vi. It also helps to avoid polyembryony.

Q9. Identify and define 'A' and 'B' in relation to uptake of water by the root :



Solution:

'A' - Symplastic path: This involves the movement of water through the cytoplasm of plant cells via plasmodesmata, which are small channels that connect cells. Water moves from cell to cell, following a concentration gradient, which allows for selective uptake of water and nutrients.

'B' - Apoplastic path: This refers to the movement of water through the cell walls and the spaces between cells, bypassing the cell membrane. This path facilitates the rapid transport of water and solutes from the root surface to the vascular tissue (xylem) for upward transport to the rest of the plant.

Q. 10. Describe mutualism?

Solution: Mutualism is a symbiotic relationship where both species involved benefit from the interaction. This cooperation enhances the survival, growth, or reproduction of each participant. Examples include pollinators like bees that gain nectar from flowers while aiding in the plant's pollination and the relationship between clownfish and sea anemones, where the fish receives protection from predators, and the anemone benefits from the cleaning and nutrient recycling the fish provide.

Q11. Explain factors affecting water absorption?

Solution:-

Presence of Capillary Water: Essential for water absorption.
- Soil Temperature: The optimal rate of water absorption occurs between $20^{\circ}\mathrm{C}$ and $30^{\circ}\mathrm{C}$.
- Soil Solute Concentration: High solute concentration in soil water reduces water absorption rate.
- Soil Aeration: Poorly aerated soils show reduced rates of water absorption.
- Transpiration Rate: Increased transpiration accelerates water absorption in irrigated soil.

Q12. What is differentiation and redifferentiation?
Solution:

(i)Differentiation

1. It is the maturation of cells derived from the apical meristem of the root and shoot. A permanent change in the structure and function of cells leading to maturation is called differentiation.
2. During cell differentiation, the cell undergoes few to major anatomical and physiological changes. For example, Parenchyma in hydrophytes develops large schizogenous interspaces for mechanical support, buoyancy, and aeration.
3. The maturation is at the cost of the capacity to divide and redivide.

(ii)Redifferentiation

The cells produced by dedifferentiation once again lose the capacity to divide and mature to perform specific functions. This is called redifferentiation. For example, secondary xylem and secondary phloem are formed from dedifferentiated cambium present in the vascular bundle.

Q. 13. Select and rewrite appropriate disorder of respiratory system with the given symptoms :

[sinusitis, emphysema, silicosis and asbestosis, laryngitis]

(a) Breakdown of alveoli, shortness of breath.

Solution: emphysema

(b) . Inflammation of the sinuses, mucous discharge.

Solution: sinusitis

(c) Inflammation of larynx, vocal cord, sore throat, hoarseness of voice, mucous build up and cough.

Solution: laryngitis

(d) Inflammation of fibrosis, lung damage.

Solution: silicosis and asbestosis

Q. 14. Explain the steps involved in preliminary treatment of sewage.

Solution:

Screening: Sewage and waste water contains plenty of suspended, floating materials, coarse and solid particles along with dissolved substances. The suspended objects are filtered and removed. This is done in screening chambers.

Grit Chamber: After screening, the filtered sewage is then passed into series of grit chambers. These chambers contain large stones (pebbles) and brick-ballast. Coarse particles settle down by gravity.

SECTION-C

Attempt any EIGHT of the following questions :

Q. 15. Give the different steps involved in formation of m-RNA from hn-RNA.
Solution:

The formation of m-RNA from hn-RNA involves a series of processing steps to convert the primary transcript into a functional mRNA molecule. The key steps involved in the processing of hnRNA to mRNA are as follows:
1. Capping - The addition of a methylated guanosine triphosphate to the 5 ' end of the hn-RNA, known as capping, which aids in mRNA stability and ribosome recognition during translation.
2. Polyadenylation - The addition of a poly (A) tail at the $3'$ end of the hn-RNA, termed polyadenylation, enhances m-RNA stability and translation efficiency.
3. Splicing - The process of removing introns and joining exons in a specific order, known as splicing, results in a mature mRNA that contains only the sequences necessary for coding the protein.

Q 16. What is reproductive isolation.

SOLUTION:
Reproductive isolation occurs due to change in genetic material, gene pool and structure of genital organs. It prevents interbreeding between populations.

Q17. Name any three types of premating isolating mechanisms.

SOLUTION:
Pre-mating or pre-zygotic isolating mechanism: This mechanism prevents fertilization and zygote formation.
1. Habitat isolation or (Ecological isolation): Members of a population living in the same geographic region but occupying separate habitats in such a way that potential mates do not meet.
2. Seasonal or temporal isolation: Members of a population living in the same geographic region but are sexually mature at different years or different times of the year.
3. Ethological isolation: Due to specific mating behavior the members of the population do not mate.
4. Mechanical Isolation: Members of two populations have differences in the structure of reproductive organs.

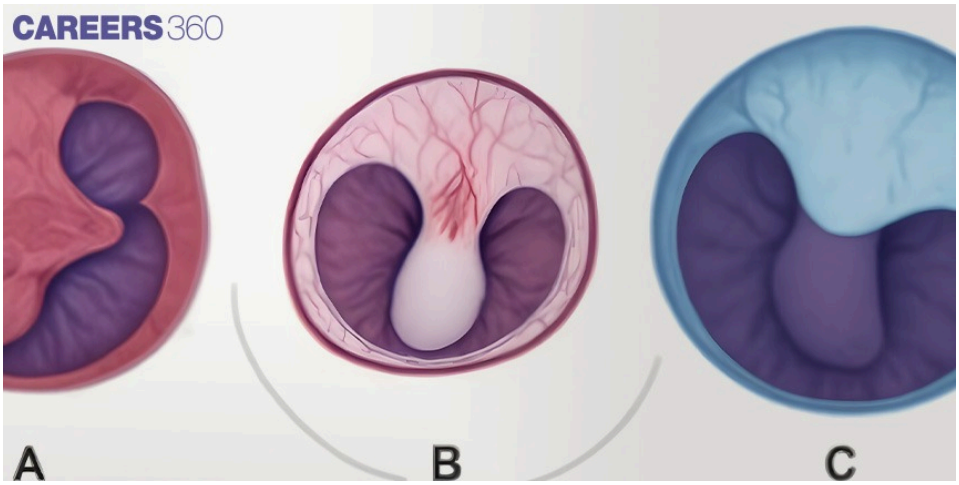
Q. 18. Name and describe hormones secreted by ovaries.

Solution: The ovaries secrete oestrogen and progesterone.

Q. 19. Explain different steps involved in PCR technique.

Solution: The three essential steps of the PCR technique are:
1. Heat denaturation: This step involves the heating of DNA at about $91^{\circ}\mathrm{C}$. The heating breaks the hydrogen bonds to make ssDNA. The DNA molecule with more G-C pairs needs a higher temperature.
2. Annealing: It is the pairing of primers to the ssDNA segment. The primers have to be designed as per the requirement. This step requires temperature at about $55^{\circ}\mathrm{C}$
3. Polymerisation: The temperature is raised to $72^{\circ}\mathrm{C}$. The Taq polymerase adds dNTPs behind the primer on the ssDNA. These three steps constitute one cycle of the reaction ($3-5\mathrm{mins}$). The process is carried out for about 28-30 cycles beyond which its reliability decreases.

Q 20. Identify A, B, and C from the above diagrams and give their functions.



Solution:

Diagrams A, B, and C represent three types of white blood cells (WBCs) with distinct functions:
- A - Neutrophils: Neutrophils have fine granules that stain with neutral dyes, make up about 70% of total WBCs, and have a multi-lobed nucleus. They are able to move in an amoeboid manner and perform phagocytosis, playing a crucial role in destroying pathogens.
- B - Eosinophils: Eosinophils contain lysosomal granules that are stained to red colour with acidic stains like eosin. Eosinophils are about $1-3\%$ of total WBCs. The nucleus is bilobed. They destroy antigen-antibody complex by phagocytosis. Their number increases in allergic condition and they show antihistaminic property. They are also responsible for detoxification as they produce antitoxins.
- C - Monocytes: Monocytes are the largest of all the WBCs. Its nucleus is large and bean or kidney shaped. They form 35% of WBCs. Monocytes are actively motile and give rise to macrophages. They are mainly phagocytic and destroy the bacteria and dead or damaged tissue by phagocytosis.

Q 21. What are the limitations of root pressure theory.

SOLUTION:
Although the ascent of sap takes place due to root pressure, there are certain objections raised, such as -
i. It is not applicable to plants taller than 20 meters.
ii. Ascent of sap can also occur even in the absence of a root system.
iii. The root pressure value is almost nearly zero in taller gymnosperm trees.
iv. In actively transpiring plants, no root pressure is developed.
v. Xylem sap under normal conditions is under tension, i.e. it shows negative hydrostatic pressure or high osmotic pressure.

Thus, root pressure is not the sole mechanism explaining the ascent of sap in all plants of varying heights.

Q 22. Explain the greenhouse effect with reference to the gases responsible for it and their sources.
SOLUTION:
1. Carbon Dioxide (CO2): This gas arises from the burning of fossil fuels (like coal, oil, and natural gas), deforestation, and various industrial processes.
2. Methane (CH4): Emitted during the production and transport of coal, oil, and natural gas. Also results from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste

landfills.
3. Nitrous Oxide (N2O): Emitted from agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
4. Fluorinated Gases: Synthetic gases used in a range of industrial applications but are much less common; their contribution is significant due to their high global warming potential.

Q 23. Describe physiological effects and applications of ethylene.

SOLUTION:
Ethylene is the gaseous hormone. Its applications and physiological effects are as follows:
1. It promotes the ripening of fruits like bananas, apples and mangoes.
2. It stimulates the initiation of lateral roots in plants and breaks the dormancy of bud and seed.
3. It accelerates the abscission activity in leaves, flowers and fruits by forming of abscission layer.
4. Ethylene inhibits the growth of lateral buds and causes apical dominance and retards flowering.
5. It is associated with the enhancement of the process of senescence of plant organs.
6. It inhibits flowering in most plants except pineapple.
7. It causes epinasty (drooping) of leaves and flowers.
8. It increases the activity of chlorophyllase enzyme causing degreening effect in banana and Citrus fruits.

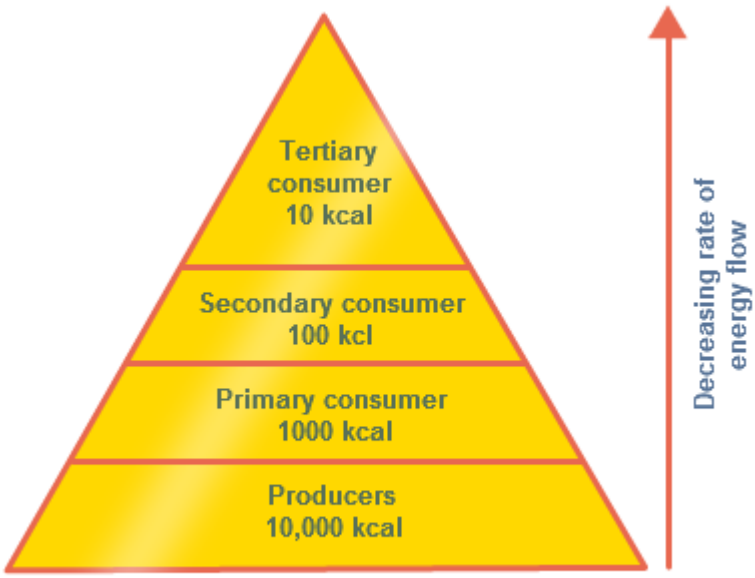
Q 24. Give the name and type of I, IV and VII cranial nerves.

SOLUTION:
I. Name- Olfactory , Type- Sensory
IV. Name- Pathetic , Type- Motor
VII. Name- Facial (bearing geniculate ganglion) , Type- Mixed

Q 25. Describe pyramid of energy with the help of diagram.

SOLUTION:

Pyramid of energy is always upright. It can never be inverted, because when energy flows from a particular trophic level only 10% pass on as net energy to the next trophic level, and large amount of energy is always lost as heat at each step. In smaller food chains, more energy is available than in the longer food chains.



Pyramid of Energy

Q 26. A.What is lac?
SOLUTION:

Lac is a resin-like substance produced by the dermal glands of the female lac insect, Trachardia lacca. The insect feeds on the succulent twigs of certain plants and secretes a pink-colored resin, which hardens upon exposure to air, forming lac.

B. Give the economic importance of lac.
SOLUTION:

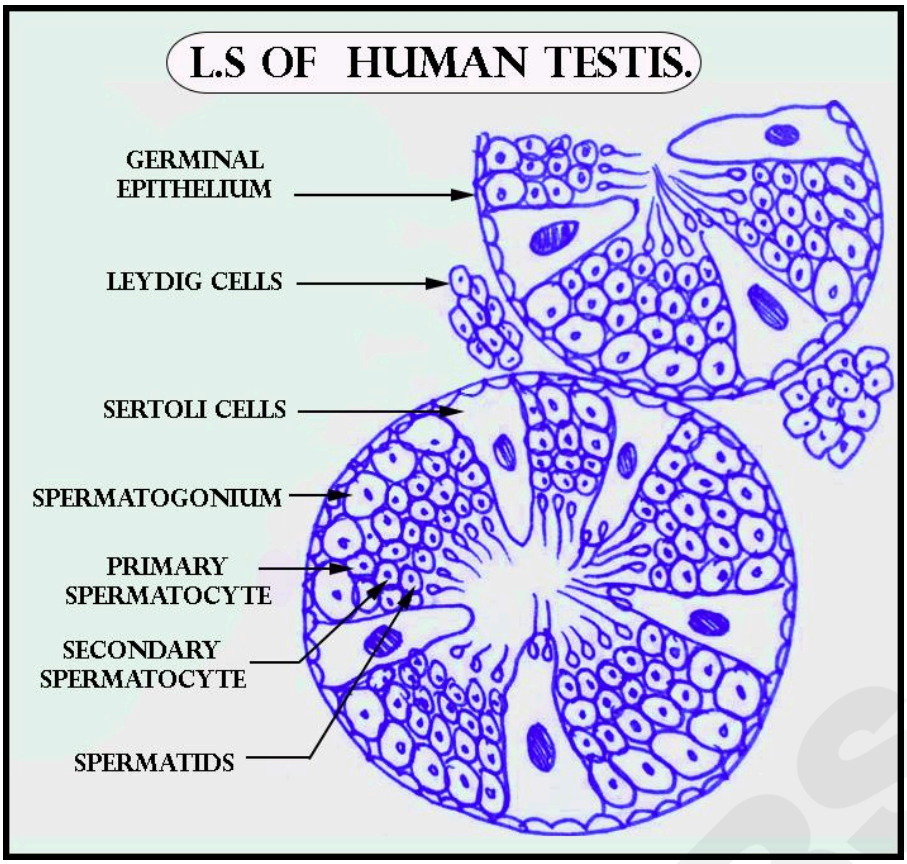
Economic importance of lac:
- a. It is used in the preparation of sealing wax, paints, varnish, electrical goods.
- It is used in the preparation of bracelets, buttons, toys and in filling hollow gold ornaments.
- It is used in artificial leather and pottery.
- It is also used in gramophone industry.
- It is used for coating fruits and vegetables

SECTION-D

Attempt any THREE of the following questions :

Q 27. Describe histological structure of Testis with well labelled diagram.

SOLUTION:



Histology of Testis:

1. Externally, the testis is covered by three layers. These are:

a. Tunica vaginalis: It is the outermost incomplete peritoneal covering made up of connective tissue and epithelium.

b. Tunica albuginea: It is the middle layer formed by collagenous connective tissue.

c. Tunica vasculosa/vascularis: It is the innermost layers. It is a thin and membranous layer.

2. Each testis is divided into about 200 -300 testicular lobules by fibres from tunica albuginea. Each lobule has 1 to 4 highly coiled seminiferous tubules.

3. Each seminiferous tubule is internally lined by a single layer of cuboidal germinal epithelial cells (spermatogonia) and few large pyramidal cells called Sertoli or sustentacular cells.

4. The germinal epithelial cells undergo gametogenesis to form spermatozoa.

5. Sertoli cells provide nutrition to the developing sperms.

6. Various stages of spermatogenesis can be seen in the seminiferous tubules. The innermost spermatogonial cell (2n), primary spermatocyte (2n), secondary spermatocyte (n), spermatids (n) and sperms (n).

7. Between seminiferous tubules, few groups of interstitial cells (Cells of Leydig) are present

8. After puberty, interstitial cells produce a type of androgen i.e. testosterone.

Q 28. A. What are chromosomal disorders?

SOLUTION:

Chromosomal disorders are a type of genetic disorder where the abnormality is in the chromosomes themselves, either due to an incorrect number of chromosomes or a structural abnormality in one or more chromosomes. This can lead to various developmental and health issues. The information provided

does not include details about specific chromosomal disorders; for a comprehensive overview, please refer to an advanced biology textbook or a medical genetics resource.

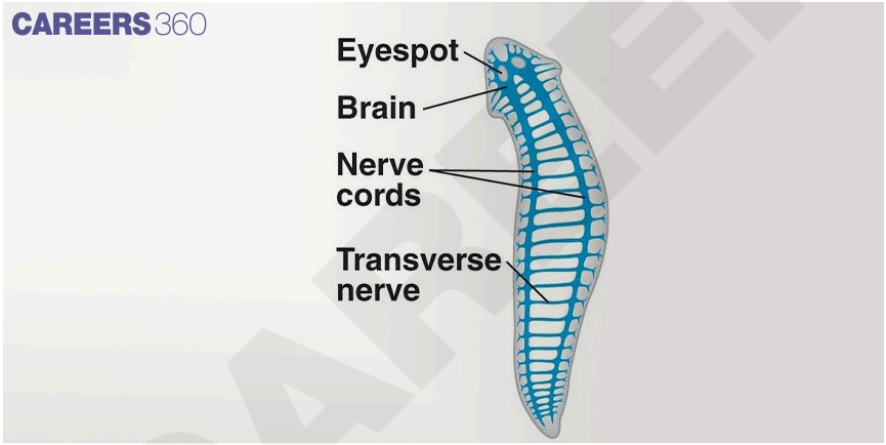
B. Describe Turner's syndrome.

SOLUTION:
Turner's syndrome is a sex chromosomal disorder caused by the non-disjunction of chromosomes during the formation of an egg. The individual born with Turner's syndrome has 44 autosomes with XO. They are phenotypically female. They have short stature (height) and a webbed neck, a lower posterior hairline, a broad shield-shaped chest, poorly developed ovaries and breasts, and low intelligence.

C.Describe Klinefelter's syndrome.
SOLUTION:
It is a chromosomal disorder caused by an extra X chromosome in males. Thus genotype of individuals is $44+\mathrm{XXY}$. They are described as feminized males. The extra chromosome is a result of the non-disjunction of the X-chromosome during meiosis in the formation of the ovum. Such an individual is male and has overall masculine development. The voice pitch is harsh and has underdeveloped testis. They are tall with long arms, showing feminine development (development of breast i.e. Gynaecomastia) and no spermatogenesis, therefore, individuals are sterile.

Q. 29. Describe nervous system in planaria with well labelled diagram.

Solution:



1. Planaria is a flatworm belonging to the phylum platyhelminthes.
2. It is the most primitive animal with a central nervous system (CNS) located on the ventral side of body.
3. It consists of a mass of cerebral or cephalic ganglion appearing like an inverted U shaped brain.
4. These lie in the anterior or head region and from each ganglion arise nine branches towards the outer side. Ventrally from below the ganglia arise a pair of Ventral Nerve Cords (VNC) or long nerve cords. These are inter connected to eachother by transfer nerve or commissure in a ladder like manner.
5. The peripheral nerve plexus arising laterally from VNC.
6. The PNS include sensory cells arranged in lateral cords in the body. A pair of photosensory structure, the eyes are located on dorsal side of the brain. Also there are single sensory cells scattered in the body.
7. In the above examples of Hydra, Planaria and the earlier studied examples of cockroach and humans, we have seen the gradual evolution or changes of the neural system.

8. There is a high level of specialization in the formation of neurons as electrically signalling cells and also in the entire system, gradually from a diffuse neural system to a centralized nervous system.
9. The expansion into a properly organized system involving the brain, its gradual expansion in size and functions.
10. This has lead to centralization of various sense organs assisting in coordinating the internal environment with that of the external environment. Also there is evolution of a complex networking system which efficiently transmits signals between one part or organ of the body and another.

Q 30. Explain following term:
A. Grafting
SOLUTION:

Here, parts of two plants are joined in such a way that they grow into one plant. In this method, part of the stem containing more than one bud (Scion) is joined onto a rooted plant called stock, is called grafting. Budding is also called bud grafting, in which only one bud is joined on the stock, $\$. g$. Apple, Pear, Rose, etc.

B.Apomixis
SOLUTION:

It is the phenomenon of the formation of the embryo(s) through the asexual reproduction method without the formation of gametes and the act of fertilization. Alternatively, it is unusual sexual reproduction where there is no meiosis and syngamy. The embryo develops in the ovule, and the ovule develops to form a seed. In apomixis, when a gametophyte organ or cell produces embryo like structure without fertilization, it is called apogamy. Similarly when a diploid sporophyte cell produces a diploid gametophyte without undergoing meiosis is called apospory, e.g. Orange, Mango.

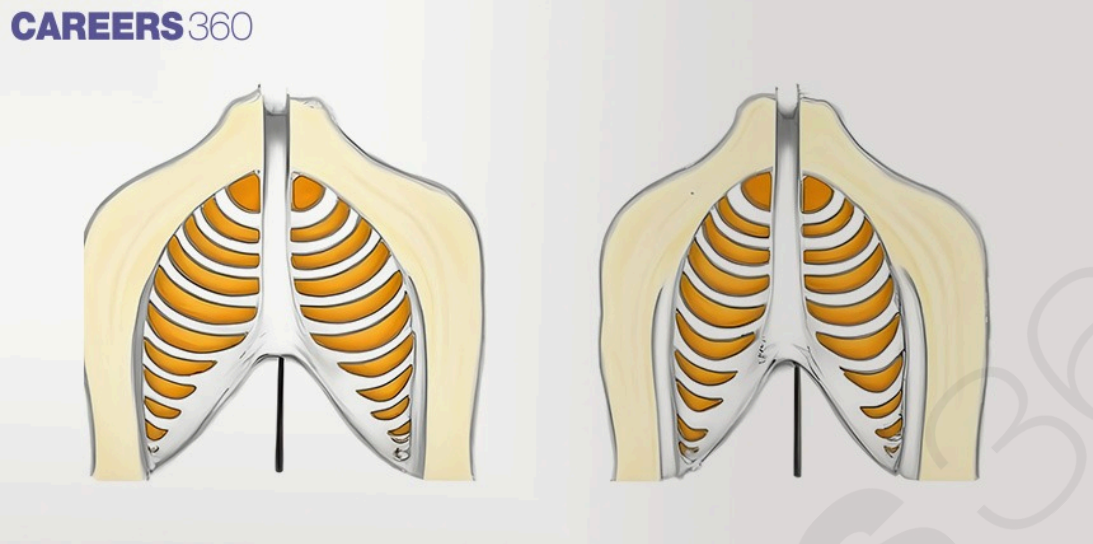
C. Polyembryony
SOLUTION:

Polyembryony is a form of seed development in angiosperms where more than one embryo forms within a single seed. It leads to the germination of multiple seedlings from one seed and is classified as either true or false based on whether the embryos arise from the same or different embryo sacs. This condition can occur due to the development of additional embryos from various maternal and zygotic tissues within the ovule. In citrus fruits, for instance, adventive polyembryony occurs when an embryo develops directly from the diploid nucellar cells, while cleavage polyembryony involves the division of a zygote into multiple units, each developing into a separate embryo. This biological feature enhances plant survival rates and has significant applications in horticulture, particularly for preserving the genetic consistency of plant varieties.

D.Parthenocarpy
SOLUTION:
- This term is coined by Noll (1902). It is the condition in which fruit is developed without the process of fertilization.
- It occurs naturally in some varieties of Pineapple, Banana, Papaya, etc.
- In these plants, it seems that the placental tissue in the unfertilized ovary produces auxin IAA (Indole-3 Acetic Acid) which is responsible for enlargement of ovary into fruit.
- The fruit resembles the normally produced fruit but it is seedless.

Q. 31. Interpret the given diagrams A and B. Enlist the changes occuring during inspiration and expiration.

Solution:



Diagrams A and B represent the human respiratory system during the processes of inspiration and expiration.
In diagram A, we observe the following changes typical of inspiration:
1. The diaphragm contracts and moves downwards, increasing the volume of the thoracic cavity.
2. The intercostal muscles contract, raising the rib cage and further increasing the thoracic volume.
3. As the volume of the thoracic cavity increases, the pressure inside decreases, leading to the inflow of air into the lungs.

In diagram B, which illustrates expiration, the opposite occurs:
1. The diaphragm relaxes and moves upwards, decreasing the volume of the thoracic cavity.
2. The intercostal muscles relax, causing the rib cage to lower, which further decreases the thoracic volume.
3. As the volume of the thoracic cavity decreases, the pressure inside increases, and air is pushed out of the lungs.

These changes in volume and pressure in the thoracic cavity are critical for the process of breathing, as they enable the flow of air in and out of the lungs.

Maharashtra Board Class 12 Biology
Solutions - 2023

SECTION-A

Q. 1. Select and write the correct answer for the following multiple choice type of questions :

(i) Histones are rich in _____.
1. alanine and glycine
2. lysine and arginine
3. histidine and serine
4. cysteine and tyrosine
SOLUTION:

Histones are rich in lysine and arginine.
Explanation:
Histones are basic proteins that are positively charged and high in the amino acids arginine and lysine. Histones bond closely to DNA, which is an acid H_4 since they are basic.

(ii) How many mitotic divisions take place during the formation of a female gametophyte from a functional megaspore?
1. One
2. Two
3. Three
4. Four
SOLUTION: Three

(iii) Which of the following is the only gaseous plant growth regulator?
1. ABA
2. Cytokinin
3. Ethylene
4. Gibberellin
SOLUTION:

Ethylene
Explanation:
It is the only gaseous growth regulator. Denny (1924) reported ethylene is effective in fruit ripening. Gane (1934) established that plants naturally synthesize ethylene.

(iv) The pH of nutrient medium for plant tissue culture is in the range of _____.
1. 2 to 4.2
2. 5 to 5.8

3. 7 to 7.5
4. 8 to 9.5
SOLUTION:

The pH of nutrient medium for plant tissue culture is in the range of $\mathbf{5}$ to 5.8 .

(v) Rivet Popper Hypothesis is an analogy to explain the significance of _____.
1. Biodiversity
2. natality
3. sex-ratio
4. age distribution ratio
SOLUTION:

Rivet Popper Hypothesis is an analogy to explain the significance of Biodiversity.

(vi) Which of the following group shows ZW-ZZ type of sex determination?
1. Pigeon, Parrot, Sparrow
2. Parrot, Bat, Fowl
3. Bat, Fowl, Crow
4. Sparrow, Fowl, Cat

SOLUTION:

Pigeon, Parrot, Sparrow

(vii) In Hamburger's phenomenon,
1. Cl^{-}diffuse into WBC
2. Cl^{-}diffuse into RBCs
3. Na^{+}diffuse into RBCs
4. Na^{+}diffuse into WBCs

SOLUTION:

In Hamburger's phenomenon, $\underline{\mathbf{Cl}^{-}\text{diffuse into RBCs.}}$.

(viii) Calcium and Phosphate ions are balanced between blood and other tissues by _____.
1. Thymosin and Parathormone
2. Calcitonin and Somatostatin
3. Collip's hormone and Calcitonin
4. Calcitonin and Thymosin

SOLUTION:

Calcium and Phosphate ions are balanced between blood and other tissues by Collip's hormone and Calcitonin.
Explanation:
The parathyroids secrete a peptide hormone called parathormone (PTH). It is also called Collip's hormone. It regulates calcium and phosphate balance between blood and other tissues. The release of parathormone increases blood calcium levels by taking calcium from bones, increasing calcium

absorption in the digestive tract and reducing the loss of calcium in the urine. Secretion of parathormone is under feedback control of blood calcium level. The concentration of calcium and phosphate is maintained by parathormone and calcitonin. These two hormones form an antagonistic pair like insulin and glucagon.

(ix) Identify the INCORRECT statement.
1. In a flaccid cell, T.P. is zero.
2. In a turgid cell, DPD is zero.
3. In a fully turgid cell, TP $=$ OP.
4. The water potential of pure water is negative.
SOLUTION:

The water potential of pure water is negative.
Explanation:
According to the principle of thermodynamics, every component of a system has a definite amount of free energy which is used to do work. Osmotic movement of water is on the basis of free energy. Free energy per molecule in a chemical system, is called its chemical potential. The chemical potential of water is called water potential. The water potential of protoplasm is equal but opposite in sign to DPD. It has a negative value. The water potential of pure water is always zero. The addition of any solute in it decreases its psi (Ψ) value. Therefore, it has a negative value.

(x) Which of the following is a hormone-releasing contraceptive?
1. $\mathrm{Cu-T}$
2. Cu-7
3. Multiload-375
4. LNG-20
SOLUTION:

LNG-20

2. Answer the following questions :

(i) Which disease is caused by HPV?

Solution: Cancer disease is caused by HPV.

(ii) Which device is used to clean both dust and gases from polluted air?

Solution: Exhaust gas Scrubbers.

(iii) Mention the name of sterile animal produced by intergeneric hybridisation.

Solution: Mule.

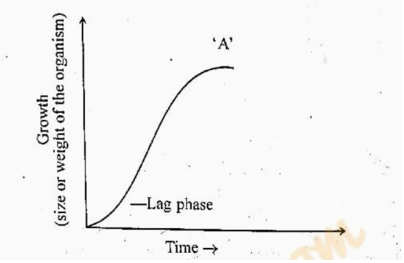
(iv) Give the name of first transgenic plant.

Solution: Tobacco.

(v) A child has low BMR, delayed puberty and mental retrardation. Identify the discase.

Solution: Cretinism.

(vi) Identify ' A ' in the given graph of population growth :



Solution: 'A' - Stationary phase.

(vii) Complete the following box with reference to symptoms of mineral deficiency :

Abscission	Pre-mature fall of flowers, fruits and leaves
	Appearance of green and non-green patches on leaves

Solution: Mottling.

(viii) Give an example of plant having both kidney and dumbbell shaped guard cells in stomata.

Solution: Cyperus.

SECTION-B

Attempt any EIGHT of the following questions :

Q 3. Define the term:
A. Gross Primary Productivity
SOLUTION:

The gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis.

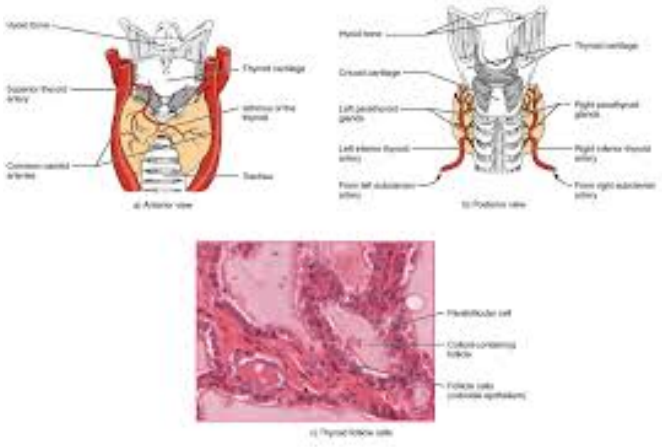
$$GPP - R = NPP$$

B. Net Primary Productivity
SOLUTION:

It refers to the entire amount of food or biomass produced by producers, minus energy losses.
$NPP = GPP -$ Respiratory loss

Q4. Draw a neat diagram of thyroid gland and label thyroid follicle, follicular cells and blood capillaries.

Solution:



Q 5. A. Give a reason $-\mathrm{ABA}$ is also known as an antitranspirant.

Solution:

ABA could cause efflux of $k+$ ions from the guard cells and result in closure of stomata. So, it is known as an antitranspirant.

B. Explain the role of chlorophyllase enzyme in banana.
SOLUTION:
In bananas, the enzyme chlorophyllase provides a degreening effect.

Q. 6. Complete the chart showing human proteins produced by rDNA technology to treat human discases and re-write.

Disorders/diseases	Recombinant Proteins
?	Erythropoietin
Asthma	?
?	Tissue plasminogen activator
Emphysema	?

Solution:

Disorders/diseases	Recombinant Proteins
Anaemia	Erythropoietin
Asthma	**Interleukin-1 receptor**
Blood clots	Tissue plasminogen activator
Emphysema	**α_1 - Antitrypsin**

Q 7. Define and or explain the term:
A. Imbibition
SOLUTION:
Imbibition is swelling up of hydrophilic colloids due to the adsorption of water.
OR
- The adsorption of water by hydrophilic compounds is called imbibition.
- A substance that adsorbs water/liquid is called imbibing and water/liquid that gets imbibed is called imbibing.
- The root hair cell wall is made up of pectic compounds and cellulose which are hydrophilic colloids.
- During imbibition, water molecules get tightly adsorbed without the formation of a solution.
- Imbibition continues until the equilibrium is reached. In other words, water moves along the concentration gradient.
- Imbibition is significant in soaking of seeds, swelling up of dried raisins, kneading of flour etc.

B. Explain how imbibition helps root hairs in adsorption of water.

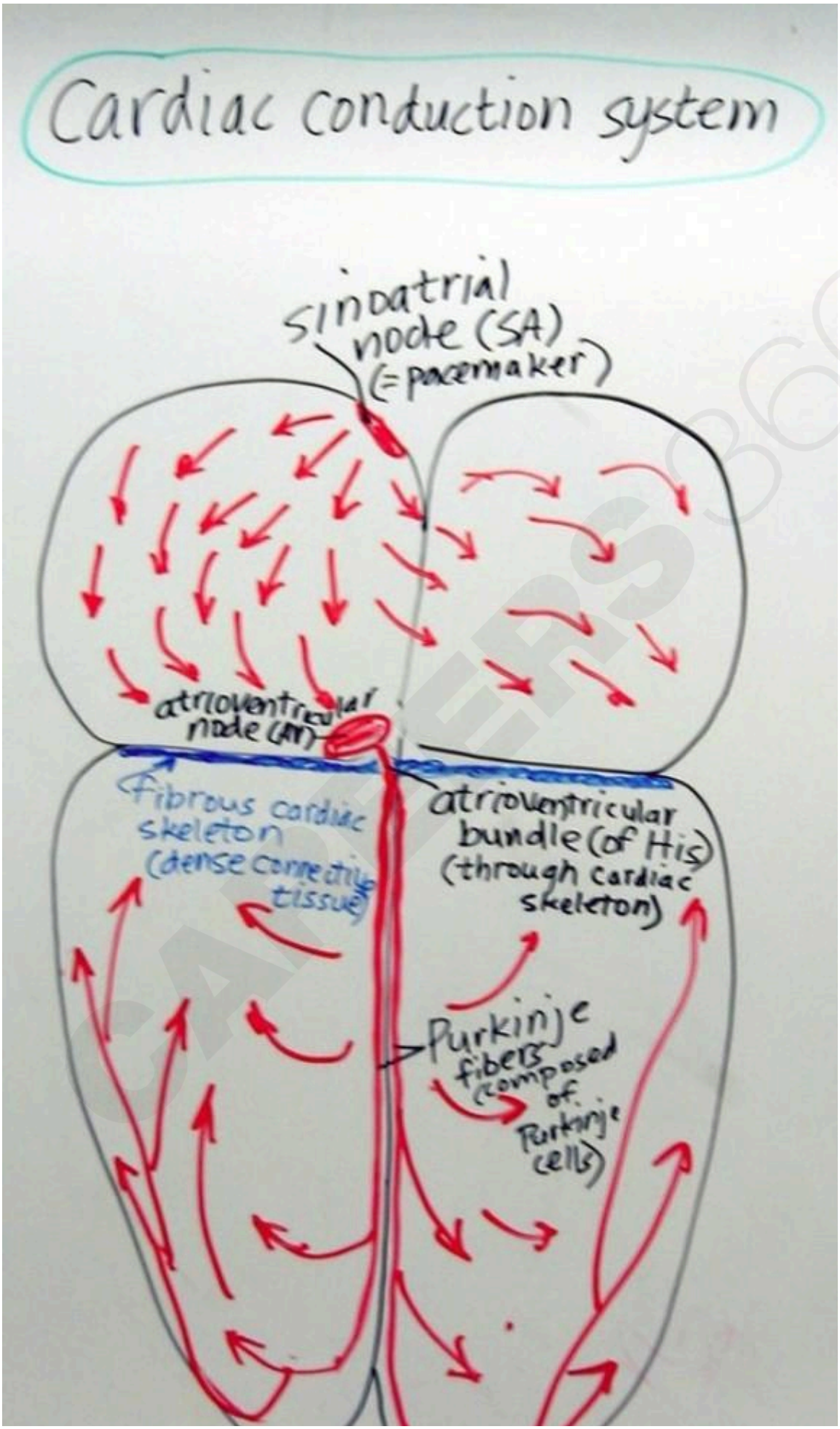
SOLUTION:

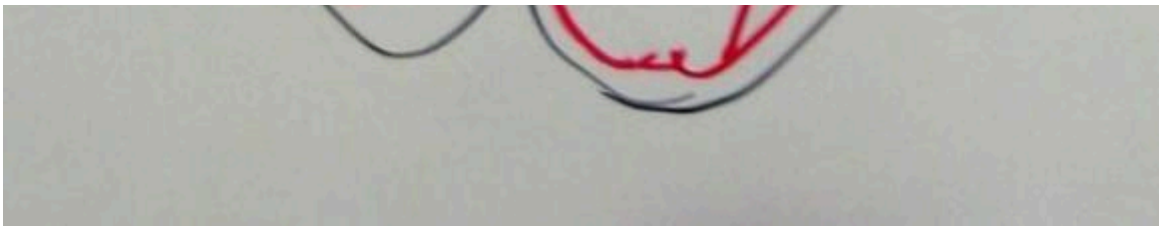
When water enters the root hair cells by imbibition, the cells swell up and increase the surface area for water adsorption. The swollen cells also exert a pulling force on the water molecules, which helps to draw water into the root.

Q. 8. Draw a neat diagram of the conducting system of human heart and label AV node, Bundle of His and Purkinje fibres.

Solution:

- The conducting system of the human heart are the network of nodes, specialised cells and electrical signals that lets heart to it's normal physiological functions.
- The muscle cells contols heart contraction and conducting cells carry electrical signals.
- Parts- Sinoatrial node, Atrioventricular node, Bundle of His and Purkinje fibers.
- AV node is located in the area of Koch , delays the signals conducted through the AV node consistently by a fraction of second ensuring that the atria are completly empty before the end of contraction.
- The Bundle of His, also known as the atrioventricular bundle receives signal from Av node and carries to the Purkinje fibers.
- The Purkinje fibers are the branches of specialised nerve fibers conducting electrical signals to the ventricles


Cardiac conduction system
sinoatrial node (SA) (=pacemaker)
atrioventricular node (AV)
fibrous cardiac skeleton (dense connective tissue)
atrioventricular bundle (of His) (through cardiac skeleton)
Purkinje fibers (composed of Purkinje cells)



Q 9. Distinguish between heterochromatin and euchromatin with reference to staining property and activity.

SOLUTION:

	Heterochromatin	Euchromatin
1.	It stains strongly and appears dark.	It stains light.
2.	It is metabolically less active.	It is metabolically more active.

Q. 10. Complete the following chart regarding energy flow in an Ecosystem and re-write :

?	Herbivores
Primary Producer	?
?	Man, Lion
Secondary consumer	?

Solution:

Primary Consumer	Herbivores
Primary Producer	Phytoplankton, grass, trees
Tertiary Consumer	Man, Lion
Secondary consumer	Birds, fish and wolf

Q 11. A. What is 'biofortification'?

SOLUTION:

Biofortification is the method of breeding of crops to produce varieties which have increased nutritional value.

B. Mention one example each of fortification with reference to -

a. Amino acid content

b. Vitamin-C content

SOLUTION:

a. Fortified Maize has twice the amount of amino acids - lysine and tryptophan.

b. Vitamin C-enriched bitter gourd and tomato have been developed by IARI.

Q. 12. Differentiate between X-clromosome and Y-chromosome with reference to -

(a) length of non-homologous regions

(b) type as per position of centromere.

Solution:

Characteristic	X-Chromosome	Y-Chromosome
(a) Length of Non-Homologous Regions	Long non-homologous region (most of the X-chromosome is non-homologous)	Short non-homologous region (majority of the Y-chromosome is non-homologous except the pseudoautosomal regions)
(b) Type as per Position of Centromere	Submetacentric (centromere is slightly off-center, creating a longer arm and a shorter arm)	Acrocentric (centromere is near the end, creating one very short arm and one very long arm)

Q 13. Define the term:
A. Genetic drift
SOLUTION:

Any random fluctuation (alteration) in allele frequency, occurring in the natural population by pure chance, is called genetic drift.

B. Homologous organs
SOLUTION:

Homologous organs are those organs, which are structurally similar but perform different functions.

Q 14. A. What is ex-situ conservation?
SOLUTION:
when a species is critically endangered. special measures have to be undertaken to protect it. It might be protected in captivity, as one of the measures of protection.

B. Mention any two places where the ex-situ conservation is undertaken.
SOLUTION:

Seed banks, Zoological parks and botanical gardens are the places where ex-situ conservation is undertaken.

SECTION-C

Attempt any EIGHT of the following questions :

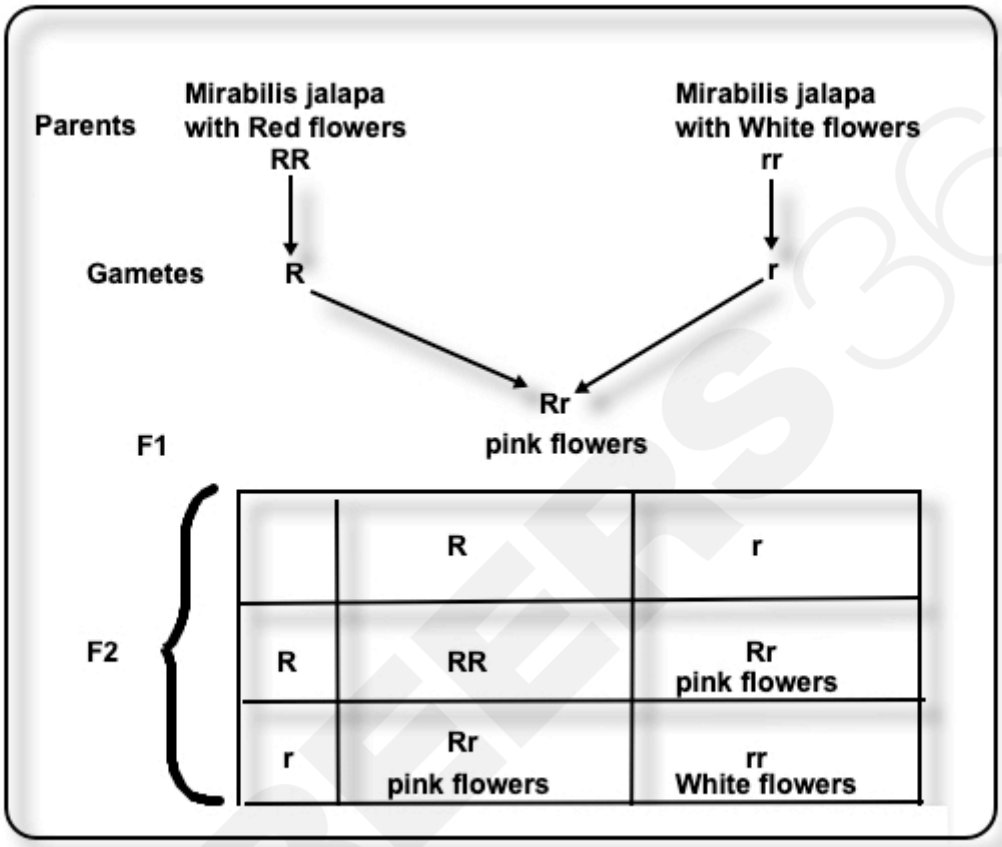
Q 15. A. Define - Incomplete dominance.
SOLUTION:

Incomplete dominance is a genetic phenomenon in which neither of the two alleles that determine a particular trait is completely dominant over the other, resulting in an intermediate phenotype that is a blend of the two.

B. If a red flowered Mirabilis jalapa plant is crossed with a white flowered plant, what will be the phenotypic ratio in F2 generation? Show it by a chart.

Solution:

A cross between red flowered and white flowered Mirabilis jalopa plant:
Phenotype of parents $\longrightarrow$ Red flowers x white flowers



F_2 Generation

♂ → / ♀ ↓	R	r
R	RR (Red)	rr (Pink)
r	Rr (Pink)	rr (White)

Phenotypic ratio $\Rightarrow 1:2:1$ (1Red : 2 Pink : 1 White)

Q. 16. (a) Differentiate between sympathetic and parasympathetic nervous system with reference to the following :

(i) Pre and postganglionic nerve fibres.

(ii) Effect on heart beat.

Solution:

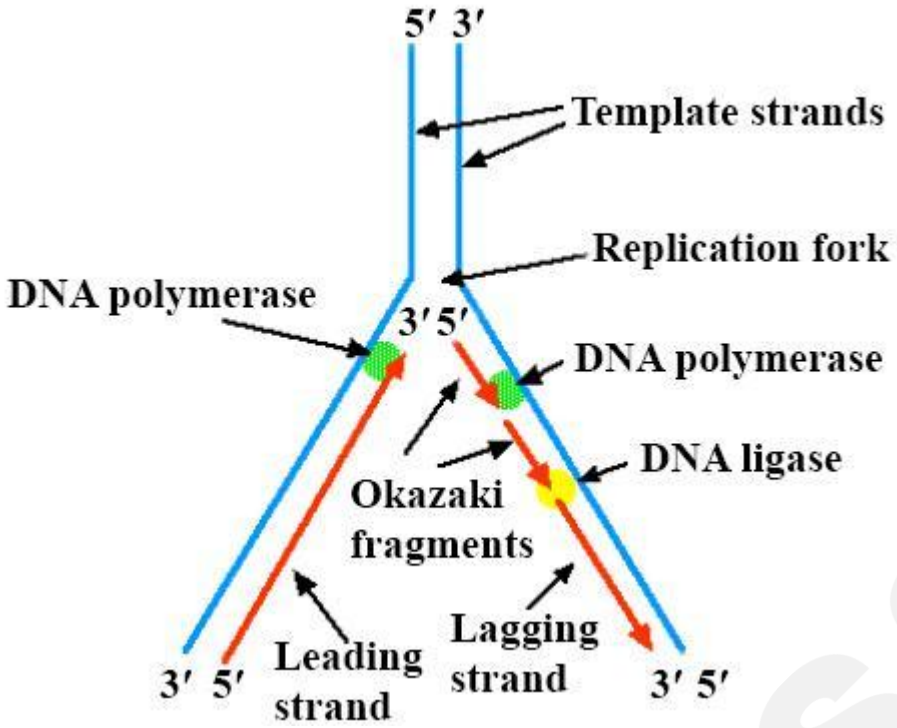
Characteristic	Sympathetic Nervous System	Parasympathetic Nervous System
(i) Pre and Post Ganglionic Nerve Fibres	Pre-Ganglionic Fibres: Short, release acetylcholine. Post-Ganglionic Fibres: Long, release norepinephrine (noradrenaline).	Pre-Ganglionic Fibres: Long, release acetylcholine. Post-Ganglionic Fibres: Short, release acetylcholine.
(ii) Effect on Heartbeat	Increases heart rate and force of contraction (fight or flight response).	Decreases heart rate and force of contraction (rest and digest response).

(b) Give reason - All spinal nerves are of mixed type.

Solution: All spinal nerves are of mixed type because they contain both sensory and motor neurons.

Q. 17. (a) Draw a suitable diagram of replication of eukaryotic DNA and label any three parts.

Solution:



(b) How many amino acids will be there in the polypeptide chain formed on the following mRNA?

5'GCCACAUGGAGAUGACGACAAAAUUUUACUAGAAAA3'

Solution: 4 amino acids will be there.

Q. 18. Describe the steps in breathing.

Solution:

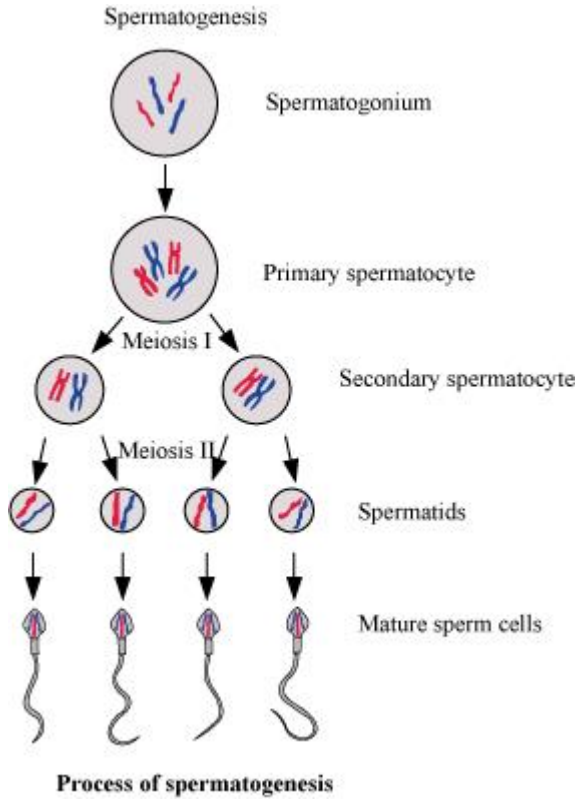
1. Inspiration: During inspiration, the atmospheric air is taken into the lungs. It occurs due to the pressure gradient formed between the lungs and the atmosphere. It is an active process in which the diaphragm becomes flat and goes downward, the external intercostal muscles contract so the ribs and sternum move upward and outward. This leads to an increase in the thoracic volume and a decrease in the pressure of the thorax and the lungs. To equalize the low pressure inside the lungs, air from the atmosphere rushes into the lungs. This is an inspiration.
2. Expiration: During expiration, the thorax contracts causing air to be exhaled. The diaphragm relaxes and is pushed upwards. It becomes dome-shaped. The intercostal muscles also relax pulling the rib cage inward and downward. This causes a decrease in thoracic volume and leads to an increase in pressure in the thorax and the lungs as compared to the atmospheric pressure. So air from the lungs rushes out. This is expiration.

Q. 19. (a) What is spermatogenesis?

Solution: The process of formation of the male gamete (sperm) or spermatozoa from the germinal epithelium of testis is called spermatogenesis.

(b) Draw a neat and labelled diagram of spermatogenesis.

Solution:



Process of spermatogenesis

Q. 20. (a) What is a connecting link?

Solution: These are fossil forms transitional or intermediate between two groups of organisms. The show shows some characters akin to both groups.

(b) Which fossil animal is considered as the connecting link between reptiles and birds? Give any one character of each class found in it.

Solution: Archaeopteryx is considered as the connecting link between reptiles and birds.
i. Reptilian character: Presence of long tail, claws and scales on the body.
ii. Avian character: Feathery exoskeleton.

Q. 21. Complete the following chart regarding population interaction and re-write :

Sr. No.	Name of Interaction	Interaction between
1	?	Plasmodium and Man
2	?	Leopard and Lion
3	?	Clownfish and Sea-anemone

Solution:

- **Plasmodium and Man**: Parasitism

- Interaction: Plasmodium (parasite) infects humans (host) causing diseases like malaria.
- **Leopard and Lion**: Competition

- Interaction: Leopards and lions compete for similar prey species and territories in overlapping habitats.
- **Clownfish and Sea-anemone**: Mutualism

- Interaction: Clownfish live within the tentacles of sea anemones, gaining protection from predators, while the anemone benefits from the clownfish's cleaning activities and food scraps.

Q. 22. (a) What is composition of bio-gas?

Solution: Biogas is a mixture of methane $\mathrm{CH_4}(50-60\%), \mathrm{CO_2}(30-40\%), \mathrm{H_2\,S}(0-3\%)$ and other gases $(\mathrm{CO}, \mathrm{N_2}, \mathrm{H_2})$ in traces.

(b) Mention any four benefits of bio-gas.

Solution:

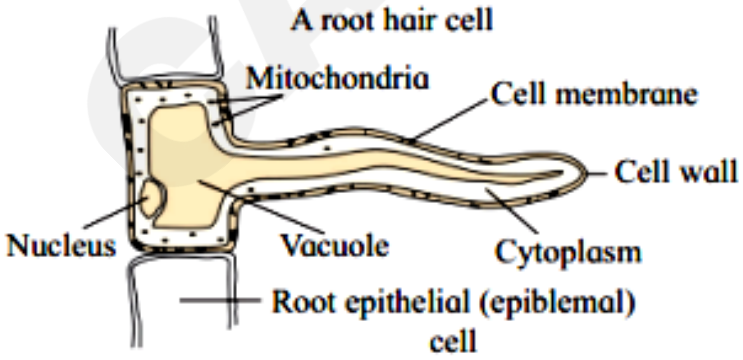
i. It is a cheap, safe and renewable source of energy.
ii. It can be easily generated, stored and transported.
iii. It can be used for domestic lighting, cooking, street lighting as well as small-scale industries.
iv. It burns with blue flame and without smoke.
v. It helps to improve the sanitation of the surroundings.
vi. It is eco-friendly and does not cause pollution and imbalance in the environment. Sludge which is left over is used as a fertilizer.

Q. 23. (a) Give reason -- Water acts as thermal buffer.

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

(b) Draw a neat and proportionate diagram of root hair and label mitochondria, nucleus and vacuole.

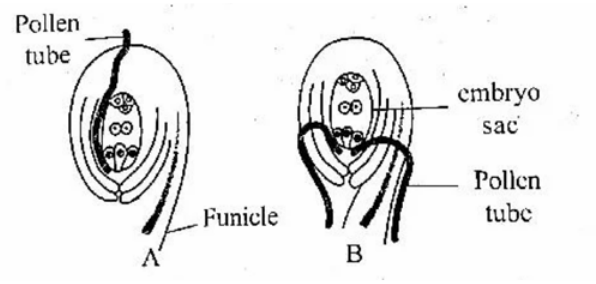
Solution:



Q. 24. Explain three main functions of free antibodies produced by B-lymphocytes.
Solution:

The following are the main functions of free antibodies, produced by B-lymphocytes:
i. Agglutination of particulate matter, including bacteria and viruses. The immobilized mass is then engulfed by phagocytes.
ii. Opsonisation or coating of bacteria to facilitate their subsequent phagocytosis by macrophages.
iii. Neutralization of toxins released by bacteria e.g. tetanus toxin.

Q. 25. (a) Following are the diagrams of the entry of the pollen tube into the ovule. Identify the types A and B.



Solution:

i. A - Chalazogamy
ii. B - Mesogamy

Q 26. (a) Name the hormone which is responsible for apical dominance.

Solution: The hormone responsible for apical dominance in plants is auxin.

(b) A farmer wants to remove broad-leaved weeds from the jowar plantation in his field. Suggest any plant hormone to remove such weeds.

Solution:2, 4-D (2,4 dichlorophenoxy acetic acid), which is synthetic auxin, can be used to remove broad-leaved weeds from the jowar plantation.

(c) Mention any two applications of cytokinin.

Solution:

i. It delays the senescence or ageing and abscission processes in plant organs.
ii. It reverses apical dominance effect.

Attempt any THREE of the following questions :

Q. 27. (a) What is blood pressure?

Sollution: The pressure exerted by blood on the wall of the blood vessels is called blood pressure.

(b) Give the name of the instrument which is used to measure the blood pressure.

Solution: Sphygmomanometer is used to measure blood pressure.

(c) Differentiate between an artery and a vein with reference to lumen and thickness of wall.

Solution:

Characteristic	Artery	Vein
Lumen (Inner Space)	Smaller lumen compared to veins.	Larger lumen compared to arteries.
Thickness of Wall	Thicker wall, especially the tunica media (middle layer).	Thinner wall, particularly the tunica media.

- **Artery:**
  - **Lumen:** Arteries have a smaller lumen, which helps maintain high pressure as blood is pumped away from the heart.
  - **Wall Thickness:** Arteries have a thick wall with a substantial tunica media (middle layer), composed of smooth muscle and elastic fibers. This structure supports the artery's ability to withstand and regulate high blood pressure.
- **Vein:**
  - **Lumen:** Veins have a larger lumen, facilitating the return of blood to the heart at lower pressure.
  - **Wall Thickness:** Veins have a thinner wall compared to arteries, with a less prominent tunica media. They rely more on valves and surrounding skeletal muscle contractions to assist in moving blood against gravity.

Function:

- **Arteries:** Carry oxygenated blood (except for pulmonary arteries) away from the heart to various parts of the body.
- **Veins:** Carry deoxygenated blood (except for pulmonary veins) from body tissues back to the heart.

Q. 28. (a) Describe any three adaptations in anemophilous flowers. Mention any one example of the anemophilous flower.

Solution:

1. The flowers are small, inconspicuous, colourless, and without nectar and fragrance (odour).
2. The pollen grains are light in weight, dry and produced in large numbers to increase chances of pollination considering the wastage of pollen grains.
3. Stigma is feathery to trap pollens carried by wind currents.
4. Stamens are exserted with long filaments and versatile anthers.
5. Stamens and stigmas are exposed to air currents.

(b) Describe any three adaptations in hydrophilous flowers. Mention any one example of the hydrophilous flower.

Solution: Maize

Q. 29. (a) What is polymerase chain reaction (PCR)?

Solution: Polymerase chain reaction (PCR) is another device used for gene cloning or gene multiplication in vitro.

(b) Describe three steps involved in the mechanism of PCR.

Solution:

At the start of PCR, all the requirements are mixed together in 'eppendorf tube' and the following operations are performed sequentially:
1. Denaturation: The reaction mixture is heated to a temperature $(90-98^{\circ}\mathrm{C})$ to separate two strands of desired DNA. This is called denaturation.
2. Annealing: The mixture is allowed to cool $(40-60^{\circ}\mathrm{C})$ that permits pairing of the primer to the complementary sequences in DNA. This step is called annealing.
3. Primer extension/Polymerization: The temperature $(70-75^{\circ}\mathrm{C})$ allows thermostable Taq DNA polymerase to use singlestranded DNA as template and adds nucleotides. This is called primer extension. It takes around two minutes duration.

Q. 30. (a) Give any four significances of fertilization in human.

Solution:

i. The secondary oocyte completes the process of oogenesis and is transformed into a mature ovum (n).
ii. The diploid chromosome number is restored in the zygote by the process of syngamy.
iii. The ovum lacks the centrioles necessary for further divisions, which are received from the sperm during fertilization.
iv. Fertilization involves the fusion of male and female gametes from the two parents. It results in variations that are significant to evolution.
v. The sex of the offspring is determined.

(b) Mention the names of any two organs each derived from ectoderm and mesoderm.

Solution:

1. Two organs derived from the ectoderm are the skin and the nervous system.
2. Two organs derived from the mesoderm are the heart and the kidneys.

Q. 31. (a) Give any two functions of cerebellum.

Solution: Functions of cerebellum:
1. It maintains body posture and body balance.
2. It coordinates muscle movement.

(b) Write the names of any four motor cranial nerves with their appropriate serial number.

Solution:

1. **Oculomotor nerve (CN III)**

- Serial Number: 3

2. **Trochlear nerve (CN IV)**

- Serial Number: 4

3. **Abducens nerve (CN VI)**

- Serial Number: 6

4. **Hypoglossal nerve (CN XII)**

- Serial Number: 12

These cranial nerves are responsible for motor functions related to eye movements (CN III, CN IV, CN VI) and tongue movement (CN XII).

(c) Which hormones stimulate liver for glycogenesis and glucogenolysis?

Solution: Insulin stimulates liver for glycogenesis and glucagon stimulates liver for glycogenolysis.

Maharashtra Board Class 12 Biology
Solutions - 2022

SECTION-A

Q. 1. Select and write the correct answer for the following multiple choice type of questions :

(i) How many meiotic and mitotic divisions occur during the development of male gametophyte from the microspore mother cell?

(a) One meiotic and two mitotic

(b) Two meiotic only

(c) Two mitotic only

(d) One mitotic and one meiotic.

Solution:

One meiotic and two mitotic
Explanation:
During microsporogenesis, microsporocytes undergo:
1. One meiotic division: To produce a tetrad of four haploid microspores. The released microspores undergo a highly asymmetric division.
2. 1^{st} Mitosis: To produce a bicellular pollen grain with a small germ cell engulfed within the cytoplasm of a large vegetative cell. The germ cell undergoes a further mitotic division.
3. 2^{nd} Mitosis: To produce twin sperm cells.

So the correct answer is one meiotic and two mitotic divisions.

(ii) During replication of DNA, the separated strands are prevented from recoiling by using .

(a) single strand binding protein

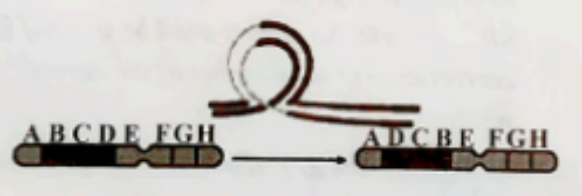
(b) reverse transcriptase

(c) endonuclease

(d) polymerase

Solution: During the replication of DNA, the separated strands are prevented from recoiling by using single strand binding.protein.

(iii)



Which event is represented by the above diagram, related to chromosomal aberrations?
(a) Deletion
(b) Duplication
(c) Inversion
(d) Translation

Solution:

In chromosomal aberrations, inversion refers to a structural rearrangement where a segment of a chromosome breaks off, rotates 180 degrees, and then reattaches to the same chromosome. This diagram typically illustrates how the segment undergoes inversion while still remaining on the same chromosome, which distinguishes it from deletion, duplication, and translation.

Hence, the answer is option (c).

(iv) hormone responsible for efflux of k^+ions from guard cells and act as antitranspirant.
(a) Gibberellins
(b) Cytokinin
(c) Ethylene
(d) Abscisic acid

Solution:

Abscisic acid hormone is responsible for the efflux of K^+ions from guard cells and acts as an antitranspirant.

(v) Test tube baby technique is called .

(a) In-vitro fertilization

(b) In-situ fertilization

(c) In-vivo fertilization

(d) Artificial insemination

Solution: Test tube baby technique is called in vitro fertilization.

(vi) While playing cricket Raju faces problem of severe pain and heaviness in the chest. Pain spreads from neck, lower jaw, left arm and to left shoulder. From above symptoms identify disease

(a) Malaria

(b) Angina pectoris

(c) Kidney failure

(d) Typhoid

Solution: Angina pectoris.

(vii) layer is in close contact of CNS in human being.

(a) Cranium

(b) Dura matter

(c) Arachnoid matter

(d) Pia mater

Solution: Pia mater layer is in close contact of the CNS in human beings.

(viii) Cellular factors in innate immunity is provided by .

(a) phagocytes

(b) antibody

(c) T - lymphocyte

(d) B - lymphocyte

Solution: Cellular factors in innate immunity is provided by phagocytes.

(ix) Pick out the appropriate association representing brood parasitism.

(a) Hermit crab and sea anemone

(b) Asian koel and common Indian crow

(c) Algae and fungi

(d) Buffalo and cattle egret

Solution: Asian koel and common Indian crow.

(x) Annealing step of PCR, operates at ____$^{\circ}$C.
(a) $90 - 98$
(b) $40 - 60$
(c) $70 - 75$
(d) $100 - 120$

Solution: Annealing step of PCR operates at $\underline{\mathbf{40 - 60}}^{\circ}$C.

Q. 2. Answer the following questions :

(i) Name the part of gynoecium that determines the compatibility of pollen grains.

Solution: The stigma of the pistil determines the compatibility of the pollen grains, by allowing only compatible pollen grains to germinate.

Pistil or carpel is the individual member of the female reproductive whorl, the Gynoecium.

(ii) Which is the primary precursor of IAA in plants?

Solution: Tryptophan is the primary precursor of IAA in plants.

(iii) Name the cell which is responsible for nitrogen fixation in cyanobacteria.

Solution: Heterocyst is responsible for nitrogen fixation in cyanobacteria. They are capable of differentiating. unique cells that fix nitrogen.

(iv) How many Biodiversity hotspots have been identified around the world?

Solution: 34 biodiversity hotspots have been identified around the world.

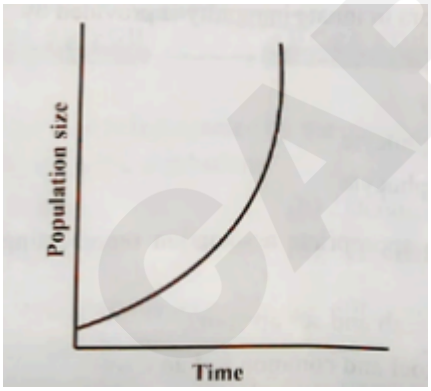
(v) Name the plant disease caused by Agrobacterium tumefaciens.

Solution: Crown gall disease.

(vi) Identify the trophoblast cells which are in contact with embryonal knob during blastulation.

Solution: Cells of Rauber.

(vii) From the given diagram, identify the type of population growth curve :



Solution: Exponential growth curve of population.

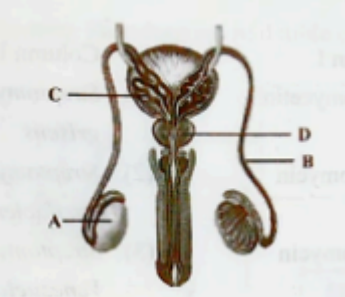
(viii) What do you mean by Pioneer species?

Solution: The first species that develop a bare area (in ecological succession), are called pioneer species.

SECTION-B

Attempt any EIGHT of the following questions :

Q. 3. Identify A, B, C, and D, in the given diagram of the human reproductive system :



Solution:

In the given diagram of the human male reproductive system, the labeled parts A, B, C, and D can be identified as follows:

A: Testis
B: Epididymis
C: Seminal Vesicle
D: Prostate Gland

Q. 4. Identify chromosomal disorder caused due to non-disjunction of 21^{st} number of chromosome and enlist its symptoms.

Solution:

Down syndrome is usually caused by an error in cell division called non-disjunction. Non-disjunction results in an embryo with three copies of chromosome 21 instead of the usual two.

Common Symptoms of Down syndrome are:
- Patients have mild or moderate mental retardation and skeletal development is poor.
- Distinct facial features like small head, ears and mouth, face is typically flat and rounded with flat nose, open mouth and protruding tongue, eyes slant up and out with internal epicanthal folds, flat hands and stubby fingers and palm is broad with single palmer crease.

Q. 5. Write the aims of human genome project.

SOlution: The main aims of the human genome project are:
I. Mapping the entire human genome at the level of nucleotide sequences.
II. To store the information collected from the project in databases.
III. To develop tools and techniques for analysis of the data.
IV. Transfer of the related technologies to the private sectors, such as industries.
V. Taking care of the legal, ethical and social issues which may arise from project.

Q. 6. Match the parts of ovule given in column I with parts of seed given in column II :

Column I	Column II

(a) egg	(1) testa
(b) nucellus	(2) tegmen
(c) outer integument	(3) perisperm
(d) inner integument	(4) embryo

Solution:

correct matches are:

- (a) egg - (4) embryo
- (b) nucellus - (3) perisperm
- (c) outer integument - (1) testa
- (d) inner integument - (2) tegmen

Q. 7. Enlist the characteristics of Neanderthal Man.

Solution: Characteristics of the Neanderthal Man are:
i. Neanderthals had strong, muscular bodies, and wide hips and shoulders.
ii. Adults grew to about 1.50-1.75 m tall and weighed about $64 - 82\ \mathrm{kg}$.
iii. Early Neanderthals were taller on average than later Neanderthals, but their weight was about the same.
iv. The model of a Homo neanderthal is a skeleton from the front and back views.

Q. 8. Define the following :
(a) Gravitational water

Solution: The water which percolates deep in the soil, due to gravity is called 'gravitational water'.
(b) Hygroscopic water

Solution: Fine soil particles imbibe/absorb water and hold it very tightly. This is called 'hygroscopic water'.
(c) Combined water

Solution: Water present in the form of hydrated oxides of silicon, aluminum, etc., is called 'combined water'.
(d) Capillary water

Solution: 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. Give different properties of water.

Solution: Properties of water:
1. Water is in the 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.

Q. 10. A person met with a small accident and bleeds, but very soon stops bleeding. Explain the physiological process responsible for this.

Solution:

When a person bleeds from a small injury but the bleeding stops quickly, it is due to the body's natural hemostatic process. Hemostasis is the physiological process that stops bleeding and involves several steps:

1. **Vascular Spasm**: Immediately after an injury, the blood vessels constrict (vasoconstriction) to reduce blood flow to the area. This is a reflex reaction that minimizes blood loss.

2. **Platelet Plug Formation**:

- **Platelet Adhesion**: Platelets in the blood adhere to the exposed collagen fibers of the damaged vessel wall.
- **Platelet Activation**: Once adhered, platelets become activated and change shape to better cover the damaged area. They also release chemicals that attract more platelets to the site.
- **Platelet Aggregation**: The activated platelets stick together to form a temporary "platelet plug" that covers the break in the vessel wall.

3. **Coagulation**: This step reinforces the platelet plug with a fibrin mesh, forming a stable blood clot. The process involves a cascade of clotting factors that ultimately lead to the conversion of the plasma protein fibrinogen into fibrin.

- The coagulation cascade has two pathways, the intrinsic and extrinsic pathways, which converge into a common pathway.
- **Intrinsic Pathway**: Triggered by damage inside the vessel.
- **Extrinsic Pathway**: Triggered by external trauma that causes blood to escape from the vessel.
- Both pathways lead to the activation of Factor X, which converts prothrombin into thrombin.
- Thrombin then converts fibrinogen into fibrin, which forms a mesh that traps blood cells and solidifies the clot.

4. **Clot Retraction and Repair**: After the clot is formed, it contracts to bring the edges of the wound closer together, reducing the size of the injury. Meanwhile, tissue repair mechanisms begin to heal the damaged vessel.

5. **Fibrinolysis**: Once the vessel is sufficiently healed, the clot is dissolved by plasmin, a fibrin-digesting enzyme, restoring normal blood flow.

These steps ensure that bleeding stops quickly and the wound is protected while it heals. This complex but efficient process is crucial for preventing excessive blood loss and protecting the body from infections and other complications related to injury.

Q. 11. Match the antibiotics in column I with their microbial sources in column II :

Column I	Column II
(a) Chloromycetin	(1) Streptomuces griseus
(b) Erythromycin	(2) Streptomyces aurifaciens
(c) Streptomycin	(3) Streptomyces Venezuelae

(d) Terramycin	(4) Sireptomyces erythreus

Solution:

Column I	Column II
(a) Chloromycetin	(3) Streptomyces venezuelae
(b) Erythromycin	(4) Streptomyces erythreus
(c) Streptomycin	(1) Streptomyces griseus
(d) Terramycin	(2) Streptomyces aurifaciens

Q. 12. Abscissic acid is the common name given to two identical substances isolated separately. Name them. Give the chemical features of abscissic acid.

Solution: The two chemical substances are Abscisin and Dormin and their chemical formula is $C_{15}H_2OO_4$.

The chemical features of Abscisic acid are:
i. It promotes abscission of leaves and induces dormancy in many plants.
ii. It controls the dormancy in buds and seeds by inhibiting growth processes.
iii. It accelerates the senescence of leaves, flowers and fruits.
iv. It inhibits and delays cell division and cell elongation and suppresses cambium activity by inhibiting mitosis in vascular cambium.
v. ABA could cause the efflux of K^+ions from the guard cells and result in the closure of stomata. So, it is known as an antitranspirant.
vi. It acts as a stress hormone by inducing the plant to bear adverse environmental conditions.
vii. It inhibits flowering in long-day plants but stimulates flowering in short-day plants.

Q. 13. What are the effects of biotechnology with relation to human health?

Solution: Effects of Biotechnology on Human Health are:
1. Allergies: GMO crops could potentially have negative effects on human health as well. Consumers have developed unexpected allergic reactions. e.g. Researchers used a gene from the Brazil nut to increase the production of Methionine in soybeans. The insertion of this gene inadvertently caused allergic reactions to the soybean in those with known nut allergies ("Biotech Soybeans").
2. Long-Term Effects: Because GMO technology has been available for such a short amount of time, there is relatively little research which has been conducted on the long-term effects on health which we cannot anticipate at this point.
3. New Proteins: Proteins that have never been ingested before by humans are now part of the foods that people consume every day. Their potential effects on the human body are as of yet unknown.
4. Food Additives: GMOs also present us with the possibility of introducing additional nutrients into foods, as well as antibiotics and vaccines. This availability of technology can provide nutrition and disease resistance to the people of those countries that don't have the means to provide these, otherwise. However, there is the possibility of the creation of antibiotic and vaccine-resistant strains of pathogens.

Q. 14. Give the adaptations shown by desert animals.

Solution: Adaptations Shown by Desert animals are:
i. Desert lizards manage to keep their body temperature fairly constant by behavioural adaptations.
ii. They bask in the sun and absorb heat, when their body temperature drops below the comfort zone, but move into the shade when the ambient temperature starts increasing.
iii. Some species burrow into the sand to hide and escape from the heat. e.g., Camel, Kangaroo, rat.

SECTION-C

Attempt any EIGHT of the following questions :

Q. 15. Explain natural selection with example of industrial melanism.

Solution:

Industrial melanism is one of the best examples of natural selection.
In Great Britain, before industrialization (1845) grey white winged moths (Biston betularia) were more in number than blackwinged moth (Biston carbonaria).

These moths are nocturnal and during day time they rest on a tree trunks. The white winged moth can camouflaged (hide in the background) well with the lichen-covered trees that helped them to escape from the predatory birds.

On other hand, the black-winged moth resting on lichen covered tree trunks were easy victims for the predatory birds and their number was reduced. During industrial revolution, large number of industries came up in Great Britain. The industries released black sooty smoke that covered and killed the lichens growing on trees and turn the tree black due to pollution. This change become an advantage to the black-winged moth that camouflaged well with the black tree trunks and their number increased while the white-winged moth become victim to predatory birds due to which their number reduced. Thus natural selection has resulted in the establishment of phenotypic traits in changing the environmental conditions.

2. 16. Describe physiological effect and applications of gaseous hormone in plants.

SOlution: Ethylene is the gaseous hormone. Its applications and physiological effects are as follows:
1. It promotes the ripening of fruits like bananas, apples and mangoes.
2. It stimulates the initiation of lateral roots in plants and breaks the dormancy of bud and seed.
3. It accelerates the abscission activity in leaves, flowers and fruits by forming of abscission layer.
4. Ethylene inhibits the growth of lateral buds and causes apical dominance and retards flowering.
5. It is associated with the enhancement of the process of senescence of plant organs.
6. It inhibits flowering in most plants except pineapple.
7. It causes epinasty (drooping) of leaves and flowers.
8. It increases the activity of chlorophyllase enzyme causing degreening effect in banana and Citrus fruits.

Q. 17. A. What is ecological succession?

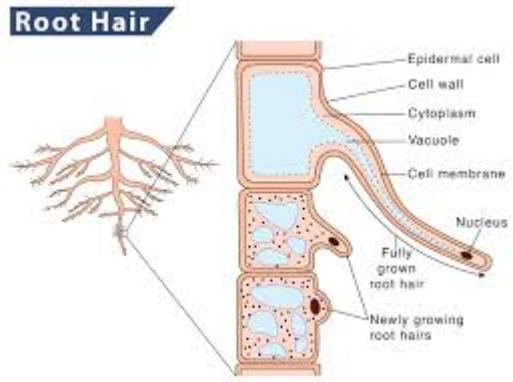
Solution: The gradual and predictable change in the species composition of a given area is called ecological succession.

B. Name various seral stages from pioneer species to climax community with suitable example in hydrarch succession.

Solution: The following are the different seral stages in hydrach succession from pioneer species to climax community:
1. Small phytoplankton are the primary successional species in aquatic settings.
2. Phytoplankton are gradually replaced by rooted-submerged plants (e.g. Hydrilla), rooted-floating angiosperms (e.g. Lotus), free-floating plants (e.g. Pistia), reed swamp (e.g. Typha), marsh-meadow (e.g. Cyperus), scrub (e.g. Alnus), and finally trees (e.g. Quercus).
3. The climax community would be a forest. The sea body transforms into land throughout time.

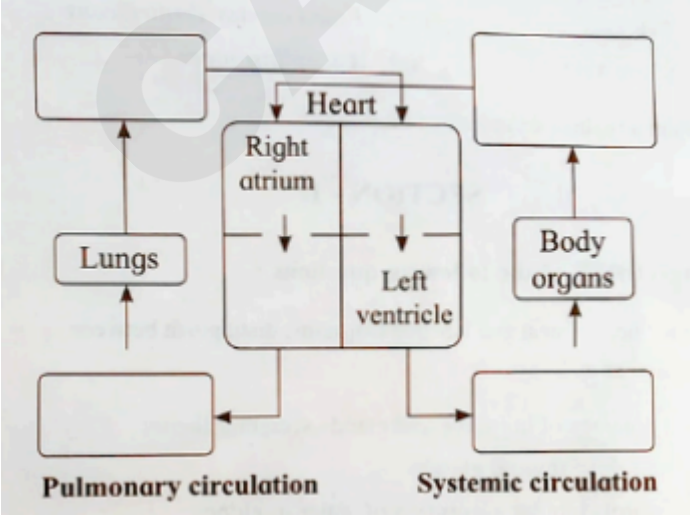
Q. 18. With the help of a neat, labelled diagram. describe the structure of root hair.

Solution:



1. Root hair is a cytoplasmic extension (prolongation) of epiblema cell.
2. Each root hair may be approximately 1 to $10\ \text{mm}$ long and tube-like structure.
3. It is colourless, unbranched, short-lived (ephemeral), and very delicate.
4. It has a large central vacuole surrounded by a thin film of cytoplasm, plasma membrane, and thin cell wall, which is twolayered.
5. Outer layer is composed of pectin and the inner layer is made up of cellulose.
6. Cell wall of a root hair is freely permeable but the plasma membrane is selectively permeable.

Q. 19. Complete the following flow diagram of double circulation :



Solution:

To complete the flow diagram of double circulation, the missing parts should be filled in as follows:

1. Blood flow from the **Body Organs** returns deoxygenated blood to the **Right Atrium**.
2. The **Right Atrium** pumps the deoxygenated blood into the **Right Ventricle**.
3. The **Right Ventricle** sends the deoxygenated blood to the **Lungs** through the pulmonary arteries.
4. In the **Lungs**, the blood gets oxygenated.
5. The oxygenated blood returns from the **Lungs** to the **Left Atrium**.
6. The **Left Atrium** pumps the oxygenated blood into the **Left Ventricle**.
7. The **Left Ventricle** sends the oxygenated blood to the **Body Organs** through the systemic arteries.

Here is the complete flow diagram:

Pulmonary Circulation:

- From **Right Ventricle → Lungs → Left Atrium**

Systemic Circulation:

- From **Left Ventricle → Body Organs → Right Atrium**

This flow ensures that oxygen-poor blood is sent to the lungs for oxygenation and oxygen-rich blood is sent to the rest of the body to supply tissues and organs.

Q. 20. Distinguish between hyperthyroidism and hypothyroidism.

Solution:

Feature	Hyperthyroidism	Hypothyroidism
Definition	Overactive thyroid producing excessive hormones	Underactive thyroid producing insufficient hormones
Metabolism	Accelerated	Slowed
Causes	Graves' disease, thyroid nodules, thyroiditis, excessive iodine intake	Hashimoto's thyroiditis, iodine deficiency, thyroid surgery or radiation therapy, certain medications
Symptoms	Rapid heartbeat, weight loss, increased appetite, sweating, heat intolerance, nervousness, anxiety, irritability, tremors, sleep disturbances, frequent bowel movements, muscle weakness, goiter (thyroid enlargement)	Fatigue, weight gain, cold intolerance, dry skin, hair loss, constipation, depression, muscle weakness, bradycardia (slow heart rate), goiter (thyroid enlargement)
Treatment	Anti-thyroid medications, radioactive iodine, surgery	Thyroid hormone replacement therapy (e.g., levothyroxine)
Common Age Group	Adults aged 20-40	Adults aged 40-60, particularly women
Commonly Affected Gender	More common in women	More common in women

Q. 21. Give the applications of DNA fingerprinting

Solution:

Definition: The technique developed to identify a person with the help of DNA restriction analysis, is known as DNA profiling or DNA fingerprinting.

Applications of DNA fingerprinting:
1. In forensic science, DNA fingerprinting is used to solve problems of rape and some complicated murder cases.
2. DNA fingerprinting is used to find out the biological father or mother or both, of the child, in case of disputed parentage.
3. DNA fingerprinting is used in the pedigree analysis in cats, dogs, horses, and humans.

Q. 22. Write a note on In-situ and Ex-situ conservation.

Solution: A. In-situ

i. Protection of an organism will automatically take place if its natural habitat is protected. e.g. Announcing Kanha forest as tiger reserve.
ii. There are 36 biodiversity hotspots.
iii. It involves the introduction of varieties traditionally used into farming and horticulture.
E.g. In Maharashtra, Pawra tribals in Satpuda have protected varieties of corn with different coloured kernels.

B. Ex-situ

1. Sometimes when a species is critically endangered, special measures have to be undertaken to protect it.
2. It might be protected in captivity, as one of the measures of protection. This is called Ex situ conservation. e.g., Wildlife safari parks, zoological parks and botanical gardens.
3. Seed banks are established to conserve wild varieties of food grains and vegetables.

Q. 23. Explain the properties of nerve fibres.

Solution:

i. Excitability/Irritability: Nerve fibres have polarized membranes, thus they have the ability to perceive stimulus and enter int
a state of activity.
ii. Conductivity: It is the ability of the nerve to transmit impulses along the whole length of the axon.
iii. Stimulus: It is any detectable, physical, chemical, electrical change in the external or internal environment which brings abou excitation in a nerve/muscle/organ/organism. A stimulus must have a minimum intensity called threshold stimulus, in order to be effective. The subliminal (weak) stimulus will have no effect while the supraliminal (strong) stimulus will produce the same degree of impulse as the threshold stimulus.
iv. Summation effect: A single subliminal stimulus will have no effect but when many such weak stimuli are given again and again they may produce an impulse due to summation of effects.
v. All or none law: The nerve will either conduct the impulse along its entire length or will not conduct the impulse at all. This occurs in the case of a subliminal or weak stimulus.
vi. Refractory period: It is the time interval (about a millisecond) during which a nerve fails to respond to a second stimulus even if it is strong.

vii. Synaptic delay: The impulse takes about 0.3 to 0.5 milliseconds to cross a synapse. It is required for the release of neurotransmitters from the axon terminal and excitation in the dendron of the next neuron.
viii. Synaptic fatigue: The transmission of nerve impulses across the synapse stops temporarily due to the depletion of the neurotransmitter.
ix. Velocity: The rate of transmission of impulse is higher in long and thick nerves. It is higher in homeotherms than in poikilotherms. The velocity of transmission is higher in voluntary fibres (100 - $120\ \mathrm{m/s}$ in man) as compared to autonomic or involuntary nerves $(10 - 20\ \mathrm{m/s}$). In medullated nerve fibre, the velocity of transmission is higher as an impulse has to jump from one node of Ranvier to the next.

Q. 24. Give the causative agent, mode of transmission and symptoms of typhoid.

Solution: Salmonella typhi

mode of transmission of typhoid:-

i. It is a food and water-borne disease.
ii. Insects like housefly and cockroaches feeding on faecal matter, may transfer the bacteria to the food material.
iii. Poor hygiene habits and poor sanitation conditions are responsible for the spread of typhoid.

symptoms of typhoid:-

1. Prolonged fever as high as $104^{\circ}\mathrm{F}$.
2. General nausea, fatigue, headache.
3. Abdominal pain, constipation or diarrhoea
4. Rose-coloured rash on skin.
5. White coat on tongue, cough.
6. Anorexia (loss of apetite).

Q. 25. Match the following

	Products		Microblal Sources
(a)	Vitamin B2	(1)	Rhizopus arrhizus
(b)	Fumaric acid	(2)	Candida lipolytica
(c)	Vitamin 812	(3)	Trichoderma konigii
(d)	Lipase	(4)	Neurospora gossypii
(e)	Cellulase	(5)	Pseudomonas denitrificans
(f)	Citric Acid	(6)	Aspergillus niger

Solution:

Correct matches are:

- (a) Vitamin B2 - (4) Neurospora gossypii

- (b) Fumaric acid - (1) Rhizopus arrhizus
- (c) Vitamin B12 - (5) Pseudomonas denitrificans
- (d) Lipase - (2) Candida lipolytica
- (e) Cellulase - (3) Trichoderma koningii
- (f) Citric Acid - (6) Aspergillus niger

Q. 26. Explain any three examples of biopiracy.

Solution:

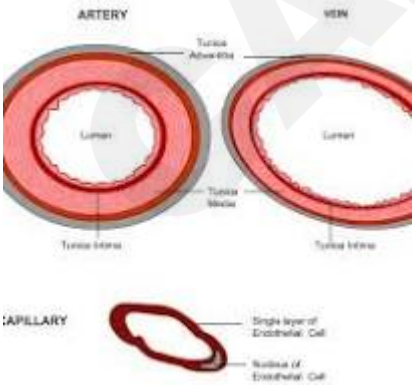
1. Patenting of Neem (Azadirachta indica): The people of India in a variety of ways have used neem, since time immemorial. Indians have shared the knowledge of the properties of the neem with the entire world. Pirating this knowledge, the USDA and an American MNC W.R. Grace in the early 90s sought a patent from the European Patent (EPO) on the "method for controlling on plants by the aid of hydrophobic extracted neem oil." The patenting of the fungicidal properties of Neem was an example of biopiracy.
2. Patenting of Basmati: Basmati is a long-grained, aromatic variety of rice indigenous to the Indian subcontinent. In the US Patent and Trademark Office (USPTO) granted a patent to a Texas based American company Rice Tec Inc for "Basmati rice line and grains" having trade name Texmati. The patent application was based on 20 very broad claims having "invented" the said rice. Due to people's movement against Rice Tec in March 2001, the USPTO has rejected a claims.
3. Haldi (Turmeric) Biopiracy: Two American researchers of Indian origin of the University of Mississippi Medical Cent a claim to the US Patent and Trademark Office, maintaining that they had discovered haldi's healing properties.

SECTION-D

Attempt any THREE of the following questions ;

Q. 27. With the help of neat and labelled diagrams, distinguish between artery and vein.

Solution:



Feature	Artery	Vein
Function	Carry oxygenated blood away from the heart	Carry deoxygenated blood towards the heart
Wall Thickness	Thick, muscular walls	Thin, less muscular walls

Valves	Absent	Present, to prevent backflow of blood
Blood Pressure	High	Lower compared to arteries
Pulse	Palpable	Less palpable
Blood Color	Bright red (oxygenated)	Dark red (deoxygenated)
Location	Deep within the body	Closer to the body surface
Size	Smaller arteries lead to arterioles	Larger veins lead to venules

Q. 28. State the names of hormones and glands secreting them :

(a) Growth of thyroid gland.

Solution:

hormons-->TSH -Thyroid Stimulating Hormone

glands--> Pituitary Gland

(b) Controls tubular absorption of water in kidney.

Solution:

hormons--> ADH - Antiduretic hormone

glands--> Hypothalamus

(c) Stimulates liver and muscles for glycogenesis.

Solution:
hormons--> Insulin

glands--> Pancreas/Islets of Langerhans

(d) Development of immune system and maturation of T-lymphocyte.

Solution:

hormons-->Thymosin Thymus Gland

gland--> Thymus Gland

Q. 29. Describe outbreeding devices which encourage cross pollination.

Solution:

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, selfpollination 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 sunflowers.
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. 30. Explain the law of dominance and compare how it differs from incomplete dominance and co-dominance.

Solution:

Law of Dominance: "When two homozygous individuals with one or more sets of contrasting characters are crossed, the alleles (characters) that appear in F_1 are dominant and those which do not appear in F_1 are recessive".
1. Incomplete Dominance: In the incomplete dominance, both the alleles (genes) of an allelomorphic pair express themselves partially. e.g.: The flower colour of Mirabilis jalapa.
2. Co-dominance: In co-dominance, both the alleles (genes) of an allelomorphic pair express themselves equally in F_1 hybrids. Such alleles which are able to express themselves equally independently in hybrids are called co-dominant alleles. Thus in codominance, both alleles are expressed. e.g.: Coat colour in cattle.

Q. 31. Describe hormonal control in various phases of menstrual cycle.

Solution:

1. Menstrual phase: Day $1^{st} - 5^{th}$ day.

The endometrium of the uterus breaks down under the effect of prostaglandins released due to decreased levels of progesterone and estrogen.
2. Proliferative phase/Follicular phase/Post menstrual phase: Day $6^{\text{th}} - 13^{\text{th}}$ day.

A few secondary follicles proceed to develop but usually one of them develops into a Graafian follicle (mature follicle). The other secondary follicles degenerate. This process of degeneration is called atresia. Developing secondary follicles secrete the hormone estrogen. The stimulation for the proliferation of new follicles is influenced by GnRH which stimulates the release of FSH.
3. Ovulatory phase: It is the shortest phase of the menstrual cycle. It involves rupturing of the mature Graafian follicle and the release of an ovum (secondary oocyte) into the pelvic cavity; usually on the 14^{th} day of the menstrual cycle. Rapid secretion of LH by a positive feedback mechanism causes the mature follicle to rupture.
4. Secretory phase/Luteal phase: Day 15^{th} to 28^{th} day.

After the release of the secondary oocyte, the remaining tissue of the Graafian follicle transforms into corpus luteum under the effect of LH. The Corpus luteum begins to secrete progesterone and estrogens. The ovulated egg may get fertilized within 24 hours. However, in the absence of fertilization, the corpus luteum can survive for only two weeks and then degenerate into a white scar called corpus Albicans.
The corpus luteum releases progesterone, a small amount of estrogens and inhibin. Under the influence of these hormones, the endometrial glands grow, become coiled and start uterine secretions. The endometrium becomes more vascularized and thickens up to 8-10 mm. Inhibin stops the secretion of FSH.