CBSE EXAMINATION PAPER-2025

BIOLOGY

(Solved)

Time allowed : 3 hours | Maximum Marks : 79

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **38 questions.** All questions are **compulsory.**

ii. This question paper is divided into **5 sections.**

iii. **Section A** – questions number **1 to 3** are case based questions

iv. **Section B** – questions number **4 to 17** are multiple choice questions

v. **Section C** – questions number **18 to 25** are very short answer

vi. **Section D** – questions number **26 to 32** are short answer

vii. **Section E** – questions number **33 to 38** are long answer

viii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

ix. Use of calculator is NOT allowed.

Section A

Question 1.

Question 2.

Study the figure given below and answer the questions that follow

(1)

(a) Identify the figure and state its importance.

[1 Marks]

Answer: The figure shows various types of cells, including red blood cells, white blood cells, columnar epithelial cells, nerve cells, and tracheids. Each cell type is uniquely shaped, reflecting its specific function in the body or plant. The importance of this figure lies in its illustration of cellular diversity and specialization, which is essential for understanding how different cells contribute to the overall functioning of organisms. For example, red blood cells' biconcave shape enhances their oxygen-carrying capacity, while the long branching structure of nerve cells allows for effective signal transmission.

Key Points: Identification of cell types-Explanation of cell shapes and functions-Understanding cellular specialization

(2)

Why is air diffused into the aerator tank ? Explain.

[2 Marks]

Answer: Air is diffused into the aerator tank to provide the necessary oxygen for aerobic microorganisms to thrive during the secondary treatment of wastewater. The addition of air ensures the availability of oxygen throughout the bioreactor, which is crucial for the metabolic processes of the microorganisms that break down organic matter in the effluent. This process not only enhances the growth of beneficial microbial flocs but also facilitates the vigorous decomposition of pollutants, leading to cleaner water being discharged from the treatment system.

Key Points: Oxygen supply for aerobic microbes-Enhances microbial growth-Breakdown of organic matter-Cleaner effluent

(3)

How is BOD related to organic matter present in the water ?

[1 Marks]

Answer: Biochemical oxygen demand (BOD) is a crucial parameter that indicates the amount of organic matter in water. It is defined as the amount of oxygen consumed by

microorganisms during the decomposition of organic material in a water sample. The higher the BOD value, the more organic matter is present in the water, leading to a greater potential for pollution. During the sewage treatment process, microorganisms break down the organic substances, thereby reducing the BOD level. This reduction in BOD reflects the decrease in organic matter, indicating that the water is becoming less polluted and more suitable for release into the environment.

Key Points: BOD measures oxygen uptake by microbes-organic matter correlation-higher BOD indicates greater pollution-reduction of BOD through microbial activity.

(4)

What changes take place in the settling tank ?

[1 Marks]

Answer: In the settling tank, after the secondary treatment in the aeration tank, several significant changes occur. The primary effluent that is rich in organic matter and microbial life is fed into the settling tank. As the effluent enters, the flow velocity decreases, allowing the heavier 'flocs' of activated sludge, which contain a mass of bacteria and fungal filaments, to settle at the bottom of the tank due to gravity. This sedimentation process helps in separating the solid biomass from the liquid portion. The settled biomass, known as activated sludge, is collected as it becomes a crucial part of the wastewater treatment process. Meanwhile, the clearer liquid that remains above, known as supernatant, is then typically drawn off and can be subjected to further treatment or discharged into the environment. This process reduces the biological oxygen demand (BOD) of the effluent, significantly lowering its pollution potential before it is released.

Key Points: Solid biomass settles due to gravity-Activated sludge forms at the bottom-Clear supernatant liquid remains above.

Question 3.

The following question is based on pollination. Study the figures carefully and answer the questions that follow.

(1)

Give the scientific terms for the processes taking place in Figures A and B respectively.

[1 Marks]

Answer: The scientific term for the process taking place in Figure A is 'Self-pollination', while the term for the process in Figure B is 'Cross-pollination'.

Key Points: Self-pollination-Cross-pollination

(2)

Mention two conditions necessary for the process occurring in Figure B.

[1 Marks]

Answer: Two conditions necessary for the process occurring in Figure B (cross-pollination) are: (1) The availability of compatible pollen grains from a different flower, and (2) A suitable pollination agent (like wind or insects) to transfer the pollen to the stigma of the receiving flower.

Key Points: Availability of compatible pollen-Role of pollination agents

(3)

State one advantage and one disadvantage of the process occurring in Figure B.

[1 Marks]

Answer: One advantage of the process in Figure B (cross-pollination) is that it increases genetic diversity among the offspring, which can lead to greater adaptability and resilience to environmental changes. A disadvantage, however, is that it often requires external agents like insects for the transfer of pollen, making it less reliable during times when such pollinators are scarce.

Key Points: Advantage: Increases genetic diversity; Disadvantage: Reliance on pollinators

(4)

Name the plant where , in some flower only the flower in progress in figure B takes place and give the reason responsible for it.

[1 Marks]

Answer: The plant where only the flower in progress in figure B takes place is a cross-pollinated flower. This is because cross-pollination involves the transfer of genetically different pollen grains to the stigma, which is necessary for the genetic diversity that enhances adaptation and survival.

Key Points: Cross-pollinated flower-genetically different pollen grains-necessary for genetic diversity

Section B

Question 4.

What are minisatellites ?

[1 Marks]

(A) 10 40 bp sized small sequences within the genes.

(B) Short coding repetitive sequences region on the eukaryotic genome.

(C) Regions of coding strand of DNA.

(D) Short non-coding repetitive sequences forming a large portion of eukaryotic genome.

Explanation: Minisatellites are defined as short non-coding repetitive sequences that form a large portion of the eukaryotic genome. They do not directly code for proteins but are involved in chromosome structure and variation, which aligns with the provided context discussing repetitive DNA in the human genome.

Question 5.

Identify the incorrect statement regarding PCR.

[1 Marks]

(A) Two sets of primers are required during polymerisation.

(B) The process of replication is repeated multiple times to produce one billion copies.

(C) Thermostable DNA polymerase is used for extension of primers.

(D) Annealing is required to separate both the strands of template DNA.

Explanation: The incorrect statement is 'Annealing is required to separate both the strands of template DNA.' This is incorrect because annealing is the stage where the primers bind to the separated strands of DNA, not the stage that separates them. The separation of DNA strands occurs during the denaturation step of PCR.

Question 6.

The following information is about drugs and tobacco. Select the correct statement from the options given below.

[1 Marks]

(A) Cocaine is given to patients after surgery as it stimulates recovery.

(B) Chewing tobacco lowers blood pressure and heart rate.

(C) Barbiturates when given to criminals makes them tell the truth.

(D) Morphine is often given to persons who have undergone surgery as a painkiller.

Explanation: Morphine is a very effective sedative and painkiller, and is often given to patients who have undergone surgery to help manage pain. This aligns directly with the information provided in the context, making the statement about morphine the correct one.

Question 7.

Given below are the events that are observed in an artificial hybridisation programme. Arrange them in the correct sequential order and select the correct option.

(i) Re-bagging

(ii) Selection of parents

(iii) Bagging

(iv) Dusting the pollens on stigma

(v) Emasculation

(vi) Collection of pollens from male parent

[1 Marks]

(A) (ii), (v), (iii), (vi), (iv), (i)

(B) (ii), (iii), (v), (vi), (iv), (i)

(C) (v), (ii), (iii), (vi), (i), (iv)

(D) (ii), (iii), (vi), (iv), (v), (i)

Explanation: The correct sequential order is (ii), (v), (iii), (vi), (iv), (i). This is because the process starts with the selection of the parent plants (ii), followed by emasculation for the female parent (v), then bagging to protect the stigma from unwanted pollen (iii), collection of pollen from the male parent (vi), dusting the collected pollen on the stigma of the female flower (iv), and finally re-bagging the flower to prevent any contamination (i).

Question 8.

Which of the following conditions correctly describes the manner of determining the sex in the given options?

[1 Marks]

(A) XO type of chromosomes determine male sex in grasshoppers.

(B) XO condition in humans determines female sex.

(C) Homozygous sex chromosomes (ZZ) determine female sex in birds.

(D) Homozygous sex chromosomes (XX) produce male in Drosophila.

Explanation: The correct option is 'XO type of chromosomes determine male sex in grasshoppers.' This is correct because in grasshoppers, males have an XO configuration, meaning they have one X chromosome and no second sex chromosome, while females have two X chromosomes. This matches the description provided in the context about XO type of sex determination.

Question 9.

Choose the option that correctly describes the gynoecium of Michelia :

[1 Marks]

(A) Multicarpellary, Apocarpous

(B) Bicarpellary, Syncarpous

(C) Bicarpellary, Apocarpous

(D) Multicarpellary, Syncarpous

Explanation: The correct option is 'Multicarpellary, Apocarpous' because the context specifically states that Michelia has a 'multicarpellary, apocarpous gynoecium'. This indicates that it has multiple carpels that are not fused together, which aligns with the provided description.

Question 10.

The given graph shows the range of variation among population members, for a trait determined by multiple genes. If this population is subjected to disruptive selection for several generations, which of the following distributions is most likely to result?

[1 Marks]

(A) A

(B) B

(C) C

(D) D

Explanation:

Disruptive selection favors individuals at both extremes of the trait distribution, leading to an increase in the frequency of these extreme phenotypes while reducing the frequency of the average phenotypes. This results in a bimodal distribution, as described in the provided context, where disruptive selection causes more individuals to acquire peripheral character values at both ends of the distribution curve.

Question 11.

Which one of the following immune system components does not correctly match with its respective role?

[1 Marks]

(A) Interferons Secreted by virus-infected cells and protect non-infected cells from further viral infection.

(B) Macrophages Mucus-secreting cells that trap microbes entering into the body.

(C) IgA Present in colostrum in early days of lactation to protect infants from diseases.

(D) B-Lymphocytes Produce antibodies in response to pathogens into blood to fight with them.

Explanation: The correct answer is 'Macrophages Mucus-secreting cells that trap microbes entering into the body.'. This is incorrect because macrophages are not mucus-secreting cells; rather, they are a type of white blood cell that engulfs and digests pathogens. Mucus-secreting cells, which help trap microbes, are typically found in epithelial tissues, not classified as macrophages.

Question 12.

Which one of the following is not the product of transgenic experiments?

[1 Marks]

(A) Drought-resistant crops

(B) High nutritional value in grains

(C) Production of insulin by rDNA technique

(D) Pest-resistant crop variety

Explanation: Production of insulin by rDNA technique is a biotechnological application, but it is not specifically a result of transgenic experiments in agriculture. The other options—drought-resistant crops, high nutritional value in grains (like golden rice), and pest-resistant crop varieties (such as Bt crops)—are all examples of transgenic modifications aimed at improving agricultural traits.

Question 13.

A biologist studied the population of rats in a granary. He found the average natality was 280, average mortality was 200, immigration was 40 and emigration was 50. The net increase in population is :

[1 Marks]

(A) 10

(B) 70

(C) 80

(D) 90

Explanation: To calculate the net increase in population, we use the formula: Net increase = (Natality + Immigration) - (Mortality + Emigration). Substituting the given values: Net increase = (280 + 40) - (200 + 50) = 320 - 250 = 70. Therefore, the correct answer is 70.

Question 14.

India has only 2.4% of the world's land area but its share of the global species diversity is :

[1 Marks]

(A) 5·1%

(B) 8·1%

(C) 7·3%

(D) 12·9%

Explanation:

The correct answer is 8·1%. This value represents a specific estimate of species diversity globally, which indicates the proportion of various species present in different ecosystems. The context provided discusses the concept of species diversity and mentions that biodiversity is not uniformly distributed, further emphasizing the significance of accurately estimating species diversity.

Question 15.

Out of the following, select the correct match :

[1 Marks]

(A) Corn Borer Cry II Ab gene

(B) Transgenic cow milk Human beta-lactalbumin protein

(C) ELISA Antigen antibody interaction

(D) Cotton plant Meloidegyne Incognitia

Explanation:

The correct match is 'ELISA'- antigen antibody interaction. ELISA is a diagnostic technique that relies on the specific binding of antigens and antibodies to detect the presence of either in a sample.

Question 16.

Assertion (A) : Swiss cheese is characterized by large holes due to CO_2 production. Reason (R) : It is ripened by growing a specific fungi.

[1 Marks]

(A) Assertion (A) is true, but Reason (R) is false.

(B) Assertion (A) is false, but Reason (R) is true.

(C) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(D) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

Explanation: Assertion (A) is true, as Swiss cheese does have large holes caused by the CO_2 produced during fermentation by specific bacteria. However, Reason (R) is false because Swiss cheese is primarily ripened by bacteria, not fungi. Therefore, the correct answer is 'Assertion (A) is true, but Reason (R) is false.'.

Question 17.

Assertion (A) : A male individual always inherits haemophilia from his mother. Reason (R) : The gene for haemophilia lies on X-chromosome.

[1 Marks]

(A) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(B) Assertion (A) is false, but Reason (R) is true.

(C) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(D) Assertion (A) is true, but Reason (R) is false.

Explanation: Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). A male inherits haemophilia from his mother because he receives one X chromosome from her, and if it carries the haemophilia gene, he will be affected. However, the assertion oversimplifies the inheritance, as haemochelia is only inherited from carrier females, not necessarily 'always' from the mother since it could also come from a father who carries the gene.

Section C

Question 18.

Name the Indian crop variety for which, in 1997, an American company got patent rights through the US Patent and Trademark Office. This is considered a case of Biopiracy.Justify.

[2 Marks]

Answer: In 1997, an American company obtained patent rights for Basmati rice through the US Patent and Trademark Office. This case is deemed Biopiracy as it involves the appropriation of a traditional Indian crop without adequate consent or compensation for the indigenous farmers who cultivated it for centuries. The patent enabled the company to commercialize a variety derived from Indian farmer's traditional varieties, ultimately denying the rightful recognition and benefits to the original cultivators.

Question 19. State two purposes for which the Indian Government has set up GEAC (Genetic Engineering Approval Committee).

[2 Marks]

Answer: The Indian Government established the Genetic Engineering Approval Committee (GEAC) to ensure the safety and effectiveness of genetically modified organisms (GMOs) before their introduction into the ecosystem. Firstly, GEAC evaluates the validity of GM research to determine its scientific reliability. Secondly, it assesses the potential environmental and health risks associated with GMOs, ensuring that public safety is prioritized in any GMO-related endeavors.

Question 20.

How does a human body respond when vaccine is introduced into it? It is said that vaccinations are a must for a healthy society. Justify.

[1 Marks]

Answer: When a vaccine is introduced into the human body, it stimulates the immune system by presenting harmless components of a pathogen, such as proteins. This triggers the production of antibodies and activates memory B and T-cells. As a result, the immune response becomes more efficient during future exposures to the actual pathogen. Vaccinations are essential for a healthy society as they can prevent the spread of infectious diseases and have eradicated diseases like smallpox.

Question 21. What are the two barriers in our body that protect it from such pathogens?

[1 Marks]

Answer: The two primary barriers in our body that protect against pathogens are physical barriers and cellular barriers. The skin serves as a physical barrier, preventing microorganisms from entering. Additionally, mucous membranes in various tracts help

trap pathogens. Cellular barriers consist of leukocytes, such as neutrophils and macrophages, which can engulf and destroy microbes that enter the body. Together, these barriers form crucial lines of defense against infections.

Question 22.

Give reasons for the following :

(i) Why can a woman generally not conceive a child after 50 years of age ?

(ii) Polar bodies are formed during oogenesis and not during spermatogenesis.

[2 Marks]

Answer: A woman generally cannot conceive after 50 years of age because this is around the time she goes through menopause, which marks the end of ovulation and significantly decreases the production of viable eggs in the ovaries. In contrast, spermatogenesis in males continues throughout life, allowing for the possibility of fatherhood at older ages. Polar bodies are produced during oogenesis due to unequal cytoplasmic division, ensuring that one ovum receives the majority of resources, while spermatogenesis produces four equal spermatids without forming polar bodies.

Question 23.

A few stages and their respective time period in the evolutionary history of human beings are mentioned in the flowchart given below :

Based on the above information, answer the following questions :

(a) Name one primate about 15 mya.

(b) Name one place where fossils of primates were discovered in Eastern Africa.

(c) Name the ancestor that lived in the East African grasslands about 2 mya.

(d) Name the hominid that was found around 1·5 mya

[2 Marks]

Answer: (a) One primate about 15 million years ago (mya) was Ramapithecus. (b) Fossils of primates were discovered in Eastern Africa, specifically in Ethiopia and Tanzania. (c) The ancestor that lived in East African grasslands about 2 mya was a man-like primate that walked upright, probably about 3-4 feet tall, who used hides and buried their dead; they are early hominids. (d) Around 1.5 mya, hominids such as Homo erectus were found, belonging to the evolutionary timeline of humans.

Question 24.

A karyotype of a human suffering from a certain disorder is given below :

(a) Identify the disorder.

(b) Write the symptoms of the disorder.

(c) Give reason for such a disorder.

[2 Marks]

Answer: The disorder is Klinefelter Syndrome, characterized by the presence of an extra X chromosome in males (47, XXY). Symptoms include reduced testosterone levels, infertility, and physical traits like taller stature, breast tissue development, and learning difficulties. The disorder occurs due to nondisjunction during meiosis, where chromosomes fail to separate properly, leading to aneuploidy. This genetic error results in the abnormal chromosome composition, causing Klinefelter Syndrome.

Question 25.

"A fully developed foetus initiates its delivery from the mothers womb" Explain.

[2 Marks]

Answer: The delivery process, known as parturition, is initiated by a fully developed foetus and the placenta. This triggers uterine contractions through a mechanism called the foetal ejection reflex. Hormones such as oxytocin, cortisol, and estrogens play crucial roles in this process. After approximately nine months of gestation, the vigorous contractions expel the baby through the birth canal, followed by the delivery of the placenta. This process marks the culmination of pregnancy.

Section D

Question 26.

A village health worker was taking a session with women. She tells them that one has to be careful while using oral pills as a method of birth control. Wrong usage can actually promote conception.

(a) Analyse the above statement and compare the merits and demerits of using oral pills and surgical methods of birth control.

(b) Village women are confused as to how a thin metallic copper loop can provide protection against pregnancy. Explain the mode of action of IUDs. Give two points.

[3 Marks]

Answer: Oral pills and surgical methods of birth control each have unique advantages and disadvantages. Oral pills are non-invasive, easily accessible, and reversible, allowing women to manage fertility without surgery. However, they require consistent daily intake, and incorrect usage can lead to unintended pregnancies. Surgical methods, such as tubal ligation, are permanent and highly effective but involve surgical risks and complications. Regarding IUDs like the copper loop, they release copper ions which create a hostile environment for sperm, preventing fertilization, and disrupting implantation, making them an effective barrier against pregnancy.

Question 27.

(a) " The process of evolution of different species in a given geographical area starts from a point and literally radiates to other

(b) Cite an example where more than one adaptive radiation has occurred in an isolated geographical area. Name the type of evolution your example depicts.

[3 Marks]

Answer:

The process described, where species evolve from a common ancestor and radiate into diverse forms in a specific geographical area, is called **adaptive radiation**. This occurs when a single ancestral species diversifies to exploit various ecological niches, leading to the formation of multiple new species.

A prime example of multiple adaptive radiations occurring in an isolated geographical area is found in the Australian marsupials. Following the separation of Australia from other continents, marsupials underwent adaptive radiation, evolving into diverse forms that filled ecological niches occupied by placental mammals elsewhere. These include kangaroos, koalas, wombats, and Tasmanian devils, each adapted to different lifestyles and habitats.
This example demonstrates convergent evolution, where marsupials independently evolved traits similar to placental mammals in other parts of the world, despite having a different ancestry.

Question 28.

A segment of DNA, 'TTG AGG GGG ATG' was translated into an oligopeptide with the amino acids, Lysine Serine Proline Tyrosine.

(a) Write the codons in correct sequence for the four amino acids.

(b) If first adenine in DNA is substituted by guanine, what will be the sequence of amino acids in the new oligopeptide ?

(c) Write the anticodons for these amino acids.

[3 Marks]

Answer: (a) The codons for the amino acids Lysine, Serine, Proline, and Tyrosine in sequence are AAA, UCU, CCA, and UAU respectively. (b) If the first adenine in the DNA is substituted with guanine, the new sequence of amino acids would change depending on the changed codon; for instance, it could result in different proteins if it alters the reading frame. The possible oligopeptide would then need to be determined based on decoding the new mRNA sequence. (c) The anticodons for Lysine, Serine, Proline, and Tyrosine are UUU, AGA, GGU, and AUA respectively.

Question 29.

A person is suffering from high grade fever. Which symptoms will help to identify if he/she is suffering from Typhoid, Pneumonia or Malaria ?

[3 Marks]

Answer: To distinguish between Typhoid, Pneumonia, and Malaria, certain symptoms are indicative of each disease. Typhoid fever typically presents with sustained high fever (39° to 40°C), weakness, stomach pain, and loss of appetite. Symptoms of Pneumonia may include fever, cough, chest pain, and difficulty breathing, often accompanied by sputum production. Malaria, on the other hand, manifests with intermittent high fever, chills, sweating, and fatigue. Accurate diagnosis can be aided by tests such as the Widal test for Typhoid, blood tests for Malaria, and chest X-rays for Pneumonia. Considering these symptom patterns is crucial in identifying the respective illness.

Question 30.

(a) Why are transgenic animals so called ?

(b) With the help of an example each, explain the role of transgenic animals in the following : (i) Vaccine safety (ii) Biological products

[3 Marks]

Answer: Transgenic animals are termed so because their DNA has been altered to include and express a foreign gene. This genetic manipulation allows researchers to study gene function and its implications in health and disease. For example, transgenic mice are crucial in vaccine safety testing. They are used to evaluate the safety of vaccines, such as the polio vaccine, to ensure that it does not produce harmful effects before human trials. Additionally, transgenic animals can produce biological products like therapeutic proteins more efficiently, reducing manufacturing costs and increasing the availability of essential medicines.

Question 31.

(a) Mention any two advantages of micropropagation techniques.

(b) Write in brief how the process is carried out in the laboratory.

(c) Name any two important food plants grown commercially by this method.

[3 Marks]

Answer: Micropropagation offers several advantages, including the ability to rapidly produce a large number of genetically identical plants, known as somaclones, from a single parent plant. This method minimizes the risk of diseases since healthy meristem tissues can be used for propagation. The process involves several steps: first, a small piece of plant tissue is sterilized and placed on a nutrient agar medium. This induces cell division and growth. After the formation of shoots and roots, the plants are acclimatized before being transferred to soil. Important food plants grown using micropropagation include banana and tomato, which are widely cultivated due to their high demand.

Question 32.

Name the type of food chains responsible for the flow of larger fraction of energy in an aquatic ecosystem and a terrestrial ecosystem, respectively. Mention any two differences between the two food chains.

[3 Marks]

Answer: In an aquatic ecosystem, the type of food chain primarily responsible for the flow of a larger fraction of energy is the Grazing Food Chain (GFC). Conversely, in a terrestrial ecosystem, a significant portion of energy flows through the Detritus Food Chain. Key differences between these two food chains include: 1) The Grazing Food Chain is initiated by primary producers like phytoplankton, whereas the Detritus Food Chain begins with decomposing organic matter. 2) The Grazing Food Chain typically supports fewer trophic levels with larger organisms, while the Detritus Food Chain usually involves more organisms at lower trophic levels, such as bacteria and fungi, thus enhancing nutrient recycling.

Section E

Question 33. Write the features a molecule should have to act as a genetic material. In the light of the above features, evaluate and justify the suitability of the molecule that is preferred as an ideal genetic material.

[5 Marks]

Answer: For a molecule to function as genetic material, it must possess several essential features. Firstly, it should be capable of self-replication, ensuring that it can duplicate itself faithfully during cell division. This is crucial for the transmission of genetic information to

the next generation. Secondly, the molecule must exhibit chemical and structural stability, allowing it to endure various environmental conditions without mutating. Thirdly, it should be able to express itself through Mendelian characters, enabling traits to manifest in offspring. Among the potential candidates, DNA (deoxyribonucleic acid) stands out as the ideal genetic material. Compared to RNA, DNA is more stable due to its double-helix structure and deoxyribose sugar, which is less reactive than ribose found in RNA. DNA's stable nature ensures that genetic information remains intact over time, safeguarding against mutations. Furthermore, its ability to undergo precise base pairing enables accurate replication and transcription processes. RNA, while capable of acting as genetic material in some viruses, lacks the same level of stability. Therefore, considering the criteria mentioned, DNA is unequivocally the most suitable genetic material, serving as a reliable blueprint for life across diverse organisms.

Question 34.

Study the given diagram showing the sectional view of a seminiferous tubule.

Answer the following questions:

(i) Label A, B, C and D in the figure.

(ii) What will be the number of chromosomes in secondary spermatocyte and spermatid respectively?

(iii) Explain the terms Spermiogenesis and Spermiation.

[5 Marks]

Answer: In the diagram of a seminiferous tubule, A represents spermatogonia, B indicates primary spermatocytes, C shows secondary spermatocytes, and D is the spermatids. The secondary spermatocyte is haploid, containing 23 chromosomes, resulting from the first meiotic division of the primary spermatocyte, which is diploid with 46 chromosomes. Spermiogenesis is the process where spermatids differentiate into mature sperm cells, involving significant morphological changes. Spermiation refers to the release of fully formed sperm from the Sertoli cells into the lumen of the seminiferous tubule, allowing progression into the reproductive tract for maturation and eventual fertilization.

Question 35.

How does alien species invasion cause a decline in biodiversity? Explain. How have the following contributed to biodiversity loss?

I. Nile Perch

II. Lantana and Eichhornia

III. Clarias gariepinus

(ii) Why have certain regions been declared as biodiversity hotspots by environmentalists of the world ? Name any two such regions in India.

[5 Marks]

Answer: Alien species invasion causes a decline in biodiversity by disrupting existing ecosystems. When non-native species, such as the Nile perch, are introduced, they can outcompete native species for resources, leading to their decline or extinction. For instance, the Nile perch in Lake Victoria caused the extinction of over 200 native cichlid species. Similarly, invasive plants like Lantana and Eichhornia proliferate uncontrollably, overpowering native flora and altering habitats. The African catfish Clarias gariepinus similarly threatens indigenous catfish populations. Regions are declared biodiversity hotspots due to their significant levels of endemic species and high rates of habitat loss. In India, the Eastern Himalayas and Western Ghats are notable hotspots, reflecting high biodiversity and urgent conservation needs.

Question 36.

(b) Differentiate between the following :

(i) Polygenic Inheritance and Pleiotropy

(ii) Dominance, Codominance and Incomplete dominance

[5 Marks]

Answer: Polygenic inheritance refers to a genetic trait controlled by multiple genes, leading to continuous variation in phenotypes, such as height or skin color. These traits do not follow simple Mendelian inheritance. In contrast, pleiotropy occurs when a single gene affects multiple traits, resulting in various phenotypic outcomes from one genetic factor, such as the Marfan syndrome affecting the skeletal system and cardiovascular health.\n\nRegarding dominance, it refers to the relationship between alleles where one allele masks the expression of another. Codominance occurs when both alleles are expressed equally, as seen in AB blood type. Incomplete dominance represents a blending of traits, where the phenotype is an intermediate between two parental traits, such as red and white flowers resulting in pink offspring. These concepts illustrate the complexity of genetic inheritance beyond Mendel's principles.

Question 37.

Study the figures given below showing initial stages in the formation of female gametophyte and answer the questions that follow.

(i) Identify (P) and (Q).

(ii) I. What kind of division does cell (P) undergo to form (Q) ?

II. How many (Q) cells form the embryo sac ? What is the name given to such kind of development ?

III. How many free nuclear mitotic divisions will the functional megaspore undergo to form the embryo sac ?

IV. Describe the structure of a mature female gametophyte.

[5 Marks]

Answer: In the context of the formation of the female gametophyte, (P) is identified as the megaspore mother cell (MMC), a diploid structure that undergoes meiosis to produce (Q), the functional megaspore, which is haploid. The cell (P) undergoes meiosis to form (Q). The functional megaspore will divide mitotically, resulting in an 8-nucleate embryo sac, demonstrating monosporic development. This involves three free nuclear divisions to form the eight nuclei, with subsequent cell wall formations organizing these nuclei into the mature female gametophyte, which consists typically of seven cells: one egg cell, two synergids, three antipodal cells, and one central cell containing two polar nuclei.

Question 38.

(i) Write an equation for Verhulst-Pearl Logistic Growth Curve where : N = Population density at t r = Intrinsic rate of natural increase (ii) Draw a graph for a population whose population density has reached carrying capacity. (iii) Draw a growth curve where resources are non-limiting to growth of population. (iv) Which growth curve is considered more realistic and why ? Explain

[5 Marks]

Answer: The Verhulst-Pearl Logistic Growth Equation is given by: $dN/dt = rN(1 - N/K)$, where N is the population density at time t, r is the intrinsic rate of natural increase, and K is the carrying capacity of the environment. In the absence of limiting factors, population growth follows an exponential model, represented by a J-shaped curve. In contrast, when resources become limited, growth transitions to logistic growth, depicted as an S-shaped curve. The logistic growth model is deemed more realistic as it accounts for environmental carrying capacity, which ultimately limits population size due to resource competition. While exponential growth can occur briefly, in natural settings populations commonly stabilize at or near K due to varied limiting factors such as food, space, and predation. Thus, logistic growth reflects the natural dynamics and constraints of ecosystems better than exponential growth.