CBSE EXAMINATION PAPER-2022

BIOLOGY

(Solved)

Time allowed : 3 hours | Maximum Marks : 59

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **30 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 13** are multiple choice questions

v. **Section C** – questions number **14 to 21** are very short answer

vi. **Section D** – questions number **22 to 27** are short answer

vii. **Section E** – questions number **28 to 30** 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.

Development of recombinant DNA technology has opened gates to many breakthroughs in the fields of medicine and agriculture. This has enabled scientists to isolate, sequence and manipulate individual genes obtained from diverse living or dead cells. Given below is a diagram showing the basic steps involved in genetically modifying an organism. Study the given diagram and answer the questions that follow :

(i) Are two different types of restriction endonucleases used, one to cut the vector DNA and another to cut the desired DNA to be cloned ? Support your answer, giving reason. (ii) Which enzyme is used at step (X) to integrate the foreign DNA with the vector DNA ?

(iii) What is the term used for step (Y) showing multiple copies of the foreign DNA being formed in transformed E. coli ?

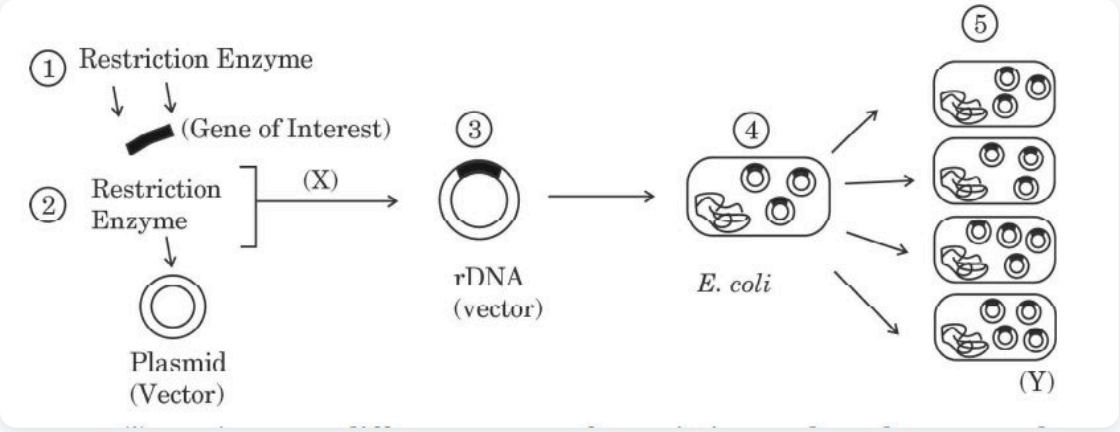
(iv) Draw a diagram of E. coli cloning vector pBR322 to show the following :

(I) Any one restriction endonuclease site in tetracycline resistance gene

(II) Any one restriction endonuclease site in ampicillin resistance gene

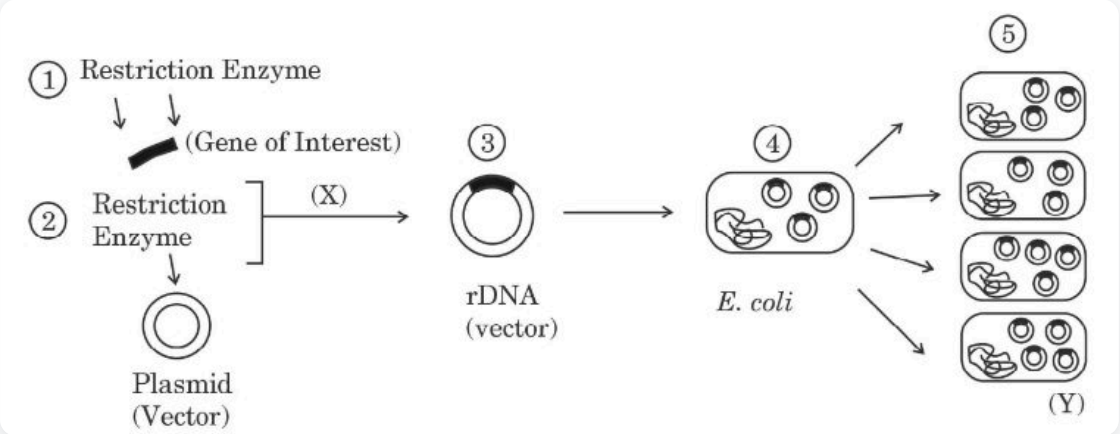
(III) 'ori' site

(v) What does rop code for in plasmid pBR322 ?



Question 2.

Development of recombinant DNA technology has opened gates to many breakthroughs in the fields of medicine and agriculture. This has enabled scientists to isolate, sequence and manipulate individual genes obtained from diverse living or dead cells. Given below is a diagram showing the basic steps involved in genetically modifying an organism. Study the given diagram and answer the questions that follow :



(1)

Are two different types of restriction endonucleases used, one to cut the vector DNA and another to cut the desired DNA to be cloned ? Support your answer, giving reason.

[1 Marks]

Answer: Yes, two different types of restriction endonucleases are typically used to cut the vector DNA and the desired DNA to ensure compatibility and successful ligation of the DNA fragments.

Key Points: Different enzymes for vector and DNA; compatibility; successful ligation

(2)

Which enzyme is used at step (X) to integrate the foreign DNA with the vector DNA ?

[1 Marks]

Answer: The enzyme used at step (X) to integrate the foreign DNA with the vector DNA is DNA ligase.

Key Points: DNA ligase; integrates foreign DNA; recombinant DNA technology

(3)

What is the term used for step (Y) showing multiple copiesof the foreign DNA being formed in transformed E. coli ?

[1 Marks]

Answer: The term used for step (Y) is 'cloning'.

Key Points: cloning-forming multiple copies-transformed E. coli

(4)

What does rop code for in plasmid pBR322 ?

[1 Marks]

Answer: In plasmid pBR322, the rop gene codes for a protein that helps in the regulation of plasmid replication by controlling the copy number of the plasmid within the host cell.

> **Key Points: rop gene - codes for replication control protein - regulates plasmid copy number**

(5)

Draw a diagram of E. coli cloning vector pBR322 to show the

following :

(I) Any one restriction endonuclease site in tetracycline

resistance gene

(II) Any one restriction endonuclease site in ampicillin

resistance gene

[1 Marks]

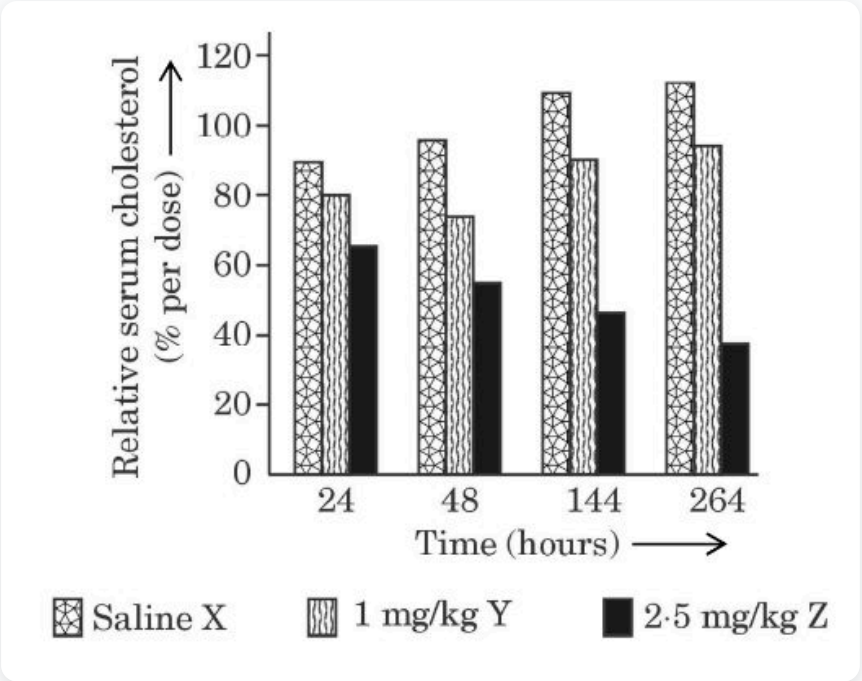
Answer: The diagram of E. coli cloning vector pBR322 shows the positions of the restriction endonuclease sites. For the tetracycline resistance gene (tetR), I have marked the EcoR I site. For the ampicillin resistance gene (ampR), I have indicated the BamH I site.

> **Key Points: E. coli cloning vector pBR322; tetR gene; EcoR I site; ampR gene; BamH I site**

Question 3.

RNA interference (RNAi) holds great potential as a therapeutic agent for the treatment of human diseases and as a bicontrol agent for controlling pests in the agricultural fields. An experiment was conducted to study the use of 'RNAi' for the potential treatment of disorders of cholesterol metabolism. Some people possess genetic mutations with elevated levels of 'ApoB' gene which predisposes them to coronary artery diseases. Lowering the amount of 'ApoB' can reduce the number of lipoproteins and

lower the blood cholesterol. Tracy Zimmerman and her colleagues used RNAi in 2006 to reduce the level of 'ApoB' in non-human primates Cynomolgus monkeys. (i) One group of monkeys were given RNAi treatment (Small interfering RNAs, SiRNAs) (doses 1 mg/kg SiRNAs), (ii) Second group of monkeys were given RNAi treatment (doses 2-5 mg/kg SiRNAs), and (iii) Third group of monkeys were injected saline as control. The results of the experiments are illustrated in the graph given below:



(1)

What do you interpret from the bars (X and Z) obtained after 264 hours of treatment of monkeys with saline and 2·5 mg/kg SiRNAs treatment ?

[1 Marks]

Answer: After 264 hours of treatment, the bar labeled Z represents the monkeys that received the 2.5 mg/kg SiRNAs treatment, showing a significant reduction in the levels of 'ApoB' compared to the bar X, which corresponds to the saline-treated control group. This indicates that the SiRNAs treatment effectively lowered 'ApoB' levels, potentially leading to decreased cholesterol levels and reduced risk of coronary artery diseases.

Key Points: Bar Z shows lower ApoB levels than Bar X - SiRNAs therapy lowers cholesterol - Indicates effectiveness of RNAi treatment

(2)

Name the category of organisms in the living world, where RNA interference (RNAi) takes place. Why ?

[2 Marks]

Answer: RNA interference (RNAi) takes place in eukaryotic organisms. This is because RNAi is a method of cellular defense that silences specific mRNAs through the action of complementary dsRNA molecules. In eukaryotes, this mechanism is utilized to regulate gene expression and defend against viruses and transposable elements.

Key Points: RNAi occurs in eukaryotic organisms-RNAi is a cellular defense mechanism-RNAi silences specific mRNA via complementary dsRNA

(3)

What is the basic principle involved in RNA interference(RNAi) in silencing the preferred genes

[2 Marks]

Answer: The basic principle of RNA interference (RNAi) involves silencing specific mRNA molecules to regulate gene expression. This process begins when a double-stranded RNA (dsRNA) is introduced into the cell, which is complementary to the target mRNA. The dsRNA is then processed into small interfering RNAs (siRNAs) that bind to the complementary mRNA, preventing its translation into protein. Consequently, this leads to the silencing of the gene associated with the targeted mRNA, effectively reducing its expression.

Key Points: Silencing specific mRNA-regulating gene expression-double stranded RNA (dsRNA) introduction-small interfering RNAs (siRNAs)-binding to target mRNA-preventing translation.

Section B

Question 4.

What is the scientific name of one bacterium that mainly attacks a person suffering from AIDS?

[1 Marks]

(A) Escherichia coli

(B) Staphylococcus aureus

(C) HIV

(D) Mycobacterium tuberculosis

Explanation: The correct answer is Mycobacterium tuberculosis. This bacterium is known to opportunistically infect individuals with weakened immune systems, such as those suffering from AIDS, making them more susceptible to tuberculosis (TB). The other options, like Escherichia coli and Staphylococcus aureus, are not primarily associated with opportunistic infections in AIDS patients, and HIV is the virus that causes AIDS, not a bacterium.

Question 5.

What is the full form of the name of the widely used diagnostic test for AIDS?

[1 Marks]

(A) Antibody Test

(B) Enzyme-Linked Immunosorbent Assay

(C) Polymerase Chain Reaction

(D) Antigen Test

Explanation: The correct answer is 'Enzyme-Linked Immunosorbent Assay' because it is the full form of the ELISA test, which is a widely used method for diagnosing AIDS by detecting antibodies to the HIV virus in the blood.

Question 6.

What does rop code for in plasmid pBR322?

[1 Marks]

(A) Replication of plasmid

(B) Antibiotic resistance

(C) Protein synthesis

(D) Gene expression

Explanation: The correct option is 'Replication of plasmid.' The rop gene in plasmid pBR322 codes for a protein that is involved in the regulation of plasmid replication, helping to maintain the proper

copy number of the plasmid within the host cell.

Question 7.

Which one of the two biogas plants can be used for generating gas fuel and electricity?

[1 Marks]

(A) Neither plant

(B) Both plants

(C) Plant B

(D) Plant A

Explanation: Based on the context, biogas primarily consists of methane and carbon dioxide, which can be used as fuel. Plant B is designed to utilize biogas for producing both gas fuel and generating electricity, making it suitable for these purposes. Plant A, on the other hand, is not specified to generate electricity. Therefore, Plant B is the correct choice as it can be used for generating both gas fuel and electricity.

Question 8.

What is the ecological term used for patches formed in an original habitat?

[1 Marks]

(A) Habitat loss

(B) Fragmentation

(C) Biodiversity

(D) Ecosystem services

Explanation: The correct option is Fragmentation. This term refers to the process where large, continuous habitats are broken into smaller, isolated patches due to human activities or natural events, leading to a decrease in habitat connectivity and biodiversity.

Question 9.

What is the scientific name of one helminth worm causing filariasis?

[1 Marks]

(A) Wuchereria bancrofti

(B) Taenia solium

(C) Ascaris lumbricoides

(D) Plasmodium falciparum

Explanation: The correct option is Wuchereria bancrofti, as it is a known species of helminth that causes lymphatic filariasis in humans. The other options refer to different parasites: Taenia solium is a tapeworm, Ascaris lumbricoides is a roundworm, and Plasmodium falciparum is a protozoan responsible for malaria.

Question 10.

What is one chronic manifestation of filariasis?

[1 Marks]

(A) Fever

(B) Headache

(C) Nausea

(D) Lymphatic obstruction

Explanation: Lymphatic obstruction is a chronic manifestation of filariasis caused by the blockage of lymphatic vessels due to the presence of filarial worms. This leads to symptoms such as swelling and elephantiasis.

Question 11.

What is the term used for step (Y) showing multiple copies of the foreign DNA being formed in transformed E. coli?

[1 Marks]

(A) Cloning

(B) Transcription

(C) Translation

(D) Replication

Explanation: The correct term is 'Cloning'. In the context of transformed E. coli, cloning refers to the process of making multiple copies of a specific piece of DNA. When E. coli is transformed with foreign DNA, it can replicate that DNA along with its own genetic material, leading to the formation of multiple copies.

Question 12.

What is the enzyme used at step (X) to integrate the foreign DNA with the vector DNA?

[1 Marks]

(A) Ligase

(B) DNA polymerase

(C) RNA polymerase

(D) Restriction endonuclease

Explanation: The correct option is Ligase. Ligase is the enzyme responsible for joining the sugar-phosphate backbone of DNA fragments, thereby integrating the foreign DNA into the vector DNA during cloning processes.

Question 13.

What is one important health hazard to a smoker?

[1 Marks]

(A) Improved lung capacity

(B) Increased risk of cancer

(C) Better cardiovascular health

(D) Enhanced immune response

Explanation: The correct answer is 'Increased risk of cancer' because smoking is a well-known cause of various types of cancer, particularly lung cancer, due to the carcinogenic substances present in tobacco smoke.

Section C

Question 14.

Though filariasis is not fatal, but the disease in humans is responsible for considerable suffering, gross deformities and disability. Write the scientific name of any two helminth worms causing the disease and state two chronic manifestations of filariasis.

[2 Marks]

Answer: The two helminth worms that cause filariasis are Wuchereria bancrofti and Brugia malayi. Chronic manifestations of filariasis include lymphedema, which is the severe swelling of the limbs, and

hydrocele, where fluid accumulates in the scrotum causing enlargement. These conditions lead to significant suffering and disability for those affected by the disease.

Key Points: Wuchereria bancrofti - Brugia malayi - lymphedema - hydrocele

Question 15.

"Curd is easier to digest by humans than milk." Justify, giving two suitable reasons.

[2 Marks]

Answer: Curd is generally easier to digest than milk due to two main reasons. First, the fermentation process involved in curd production breaks down lactose, the sugar in milk, making it suitable for lactose-intolerant individuals. Second, curd contains probiotics, which enhance gut health and aid in digestion, facilitating nutrient absorption and balancing gut flora. These factors contribute to the overall digestibility of curd compared to milk.

Key Points: Fermentation breaks down lactose-Probiotics improve gut health

Question 16.

A person suffering from AIDS dies of opportunistic infections (ARC) i.e., infections that could have been otherwise overcome.

(i) State one reason as to why an 'HIV' patient dies of 'opportunistic infections'.

(ii)Give the scientific name of one bacterium and one parasite which mainly attack a person suffering from AIDS.

(iii)Write the full form of the name of the widely used diagnostic test for AIDS.

[2 Marks]

Answer: A person suffering from AIDS has a severely weakened immune system due to the destruction of CD4 T-cells by HIV, making them susceptible to opportunistic infections. One bacterium that commonly affects AIDS patients is Mycobacterium tuberculosis, and a prevalent parasite is Toxoplasma gondii. The widely used diagnostic test for AIDS is the Enzyme-Linked Immunosorbent Assay (ELISA).

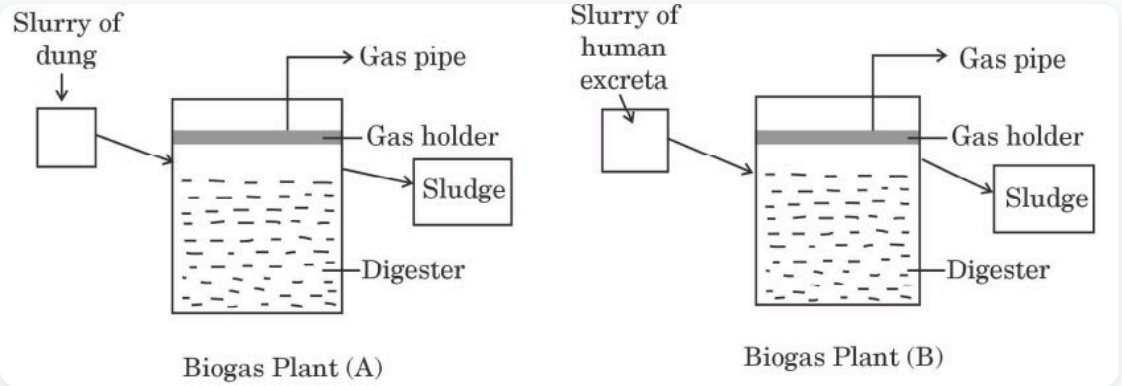
Key Points: weakened immune system-CD4 T-cells-opportunistic infections-Mycobacterium tuberculosis-Toxoplasma gondii-ELISA

Question 17.

Study the given diagrams of Biogas plants 'A' and 'B' and answer the questions that follow :

Which one of the two biogas plants can be used for generating gas fuel and electricity and why ? Give suitable reasons in support of your answer.

[2 Marks]



Answer: Biogas plant 'B' is suitable for generating both gas fuel and electricity. This plant likely incorporates a combined heat and power (CHP) system, which efficiently converts biogas into usable gas and electricity. Additionally, if plant 'B' has a larger capacity or utilizes more effective anaerobic digestion processes, it would produce more biogas. The presence of advanced technology for energy conversion confirms 'B' as the more versatile option for energy generation.

Key Points: Plant 'B' for gas fuel and electricity-Combined heat and power system-Efficient biogas conversion-Advanced technology

Question 18.

Explain the two physiological attributes which enable a kangaroo rat to survive in desert conditions.

[2 Marks]

Answer: Kangaroo rats have developed two crucial physiological adaptations for desert survival. Firstly, they possess highly efficient kidneys that concentrate urine effectively, minimizing water loss. This allows them to retain water even in extremely arid environments. Secondly, kangaroo rats have specialized nasal passages that humidify the air they breathe, reducing moisture loss through respiration. Together, these adaptations enable them to thrive in the harsh desert climate with limited water availability.

Key Points: Highly efficient kidneys - minimize water loss; Specialized nasal passages - reduce moisture loss through breathing

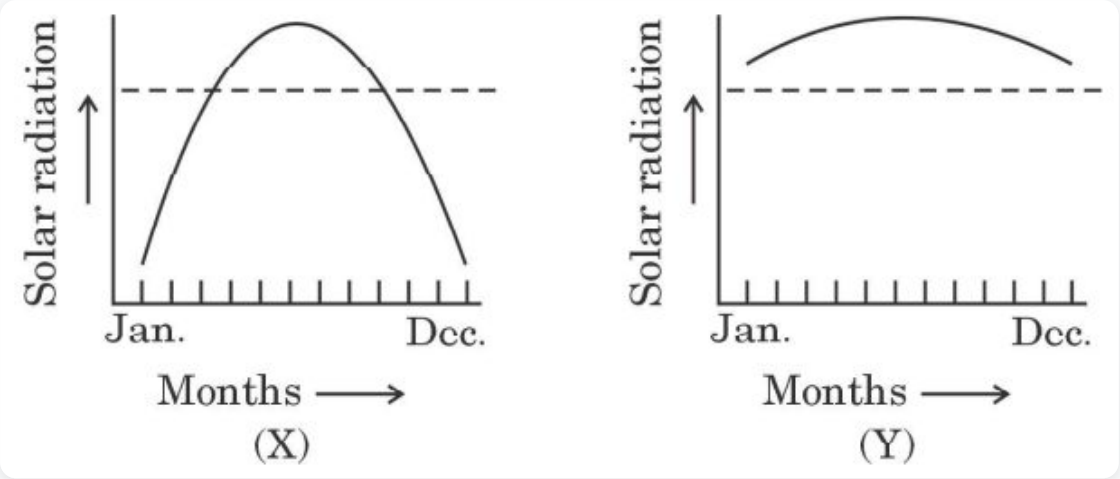
Question 19.

Study the given graphs (X) and (Y) depicting the annual variation in solar radiation on Earth from January to December and answer the undermentioned questions.

(i) Identify the graph that depicts (I) tropical region, and (II) temperate region, respectively.

(ii) Which of the two regions, (X) or (Y), will show high biological diversity and why ? Give two reasons.

[2 Marks]



Answer: Graph (X) depicts the tropical region, while graph (Y) represents the temperate region. The tropical region generally receives more consistent and higher levels of solar radiation throughout the year, leading to a stable climate. Consequently, region (X) is expected to show high biological diversity because of its consistent temperature and rainfall fostering diverse ecosystems. Additionally, tropical environments often support a wider variety of plant and animal species compared to temperate regions.

Key Points: Graph (X) = tropical region, Graph (Y) = temperate region, Tropical regions have stable climate, High biological diversity in tropical zones, Consistent temperature and rainfall.

Question 20.

In spite of the statutory warning on cigarette packets against 'smoking' and its injourius effect on health smoking is still prevalent in the society. Enumerate four important health hazards to a smoker.

[2 Marks]

Answer: Smoking poses numerous health risks to smokers, despite warnings. Four significant health hazards include: 1) Increased risk of lung cancer, which is one of the deadliest cancers. 2) Development of chronic respiratory diseases like bronchitis and emphysema, leading to breathing difficulties. 3) Higher likelihood of coronary heart disease, which can result in heart attacks. 4) Reduced oxygen levels in the body due to carbon monoxide accumulation, causing overall health deterioration.

Key Points: lung cancer-chronic respiratory diseases-coronary heart disease-reduced oxygen levels

Question 21.

(i) When prickly pear cactus was introduced into Australia in early 1920s, it caused havoc and ecosystem instability by achieving very high population densities. Explain the reason for its rapid spread into millions of hectares of rangeland.

(ii) State te importance of 'prey- predator ' relationship in a habitat.

[2 Marks]

Answer: The prickly pear cactus spread rapidly in Australia due to the absence of its natural predators. Without these predators to control its population, the cactus thrived unchecked, quickly occupying millions of hectares of rangelands. The high availability of resources such as food and space facilitated exponential growth. Eventually, biological control was implemented by introducing a cactus-feeding moth from its natural habitat, which helped regain balance in the ecosystem.

Key Points: absence of natural predators - unchecked population growth - availability of resources - exponential growth - introduction of cactus-feeding moth

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Section D

Question 22.

When Plasmodium sp. (malarial parasite) enters the human body, it reproduces asexually and increases its number. During this course, the affected person suffers from malaria. After a number of asexual cycles, the parasite, in order to complete its life cycle, enters the sexual phase of its life. Trace the sexual stages in the life cycle of Plasmodium in a female Anopheles mosquito, when it bites an infected person, up to the formation of mature infective stages of the parasite.

[3 Marks]

Answer: When a female Anopheles mosquito bites an infected human, it ingests gametocytes present in the blood. Inside the mosquito's gut, the male gametocytes undergo exflagellation to form motile male gametes, which then fuse with female gametes to form a zygote. This zygote develops into an ookinete that penetrates the mosquito's midgut wall, forming a cyst. Within this cyst, meiosis occurs, leading to the formation of thousands of sporozoites. Eventually, the mature sporozoites migrate to the salivary glands of the mosquito. When the mosquito bites another human, these infectious sporozoites are transmitted, starting the cycle anew.

Key Points: 1. Ingestion of gametocytes by mosquito 2. Formation of male and female gametes 3. Fusion to form zygote 4. Development into ookinete and cyst formation 5. Meiosis producing sporozoites 6. Migration to salivary glands and transmission to a new host

Question 23.

(a) Name and state the type of immunity that acts as a biological shield' to the developing foetus against many infections in the mother's womb.

(b) A large proportion of infants remain free from potent infections at least three months after birth, or even longer if breast fed. Explain, giving suitable reasons.

[3 Marks]

Answer: The type of immunity that acts as a biological shield to the developing fetus is called passive immunity. This immunity is conferred to the fetus primarily through the placenta, where maternal antibodies (especially immunoglobulin G, IgG) are transferred. These antibodies provide immediate protection against various pathogens to which the mother has been exposed. Furthermore, infants who are breastfed continue to receive passive immunity via colostrum and breast milk, which contain essential antibodies, such as IgA. This additional supply of antibodies helps to bolster the infant's immune defense system, keeping them protected from infections during their early months.

Key Points: Passive immunity-maternal antibodies-placental transfer-breastfeeding-immediate protection-sustained immunity

Question 24.

With the advent of sophisticated techniques of genetic engineering, we can now readily purify and isolate DNA. Name and explain the different steps involved in the separation and isolation of DNA fragments once cut by restriction endonucleases.

[3 Marks]

Answer: The separation and isolation of DNA fragments cut by restriction endonucleases involve several key steps: First, restriction enzymes digest the DNA at specific sequences, resulting in fragments. Next, agarose gel electrophoresis is employed to separate these fragments based on size, where DNA is pulled through a gel matrix by applying an electric current. Smaller fragments move faster, leading to size-based separation. Once separated, the desired DNA fragments can be excised from the gel. Finally, these fragments are purified typically using a gel extraction method, where the gel slice containing the target DNA is dissolved, and DNA is recovered and concentrated for further analysis or manipulation.

Key Points: Restriction enzyme digestion - DNA fragments produced; Agarose gel electrophoresis - separates fragments based on size; DNA purification - excising and extracting target DNA from the agarose gel

Question 25.

"Some species in an ecosystem exert greater influence in driving major ecosystem services than others." How did Paul Ehrlich explain this concept in his 'rivet popper hypothesis'?

[3 Marks]

Answer: Paul Ehrlich's 'rivet popper hypothesis' likens the intricate interactions within an ecosystem to a plane's rivets. Just as a few missing rivets can compromise an aircraft's integrity, the loss of certain species can significantly impact ecosystem functions. Each species, particularly those that are keystone species, plays a unique role and contributes to essential services such as pollination, nutrient cycling, and habitat structure. The hypothesis suggests that while ecosystems can tolerate minor variations in species, the removal of key species can lead to unforeseen consequences, diminishing the ecosystem's resilience and functionality. Ehrlich's theory emphasizes the importance of biodiversity in maintaining ecosystem stability and productivity.

Key Points: Rivet popper hypothesis analogy-Importance of keystone species-Impact of species loss on ecosystem functions-Ecosystem resilience and biodiversity

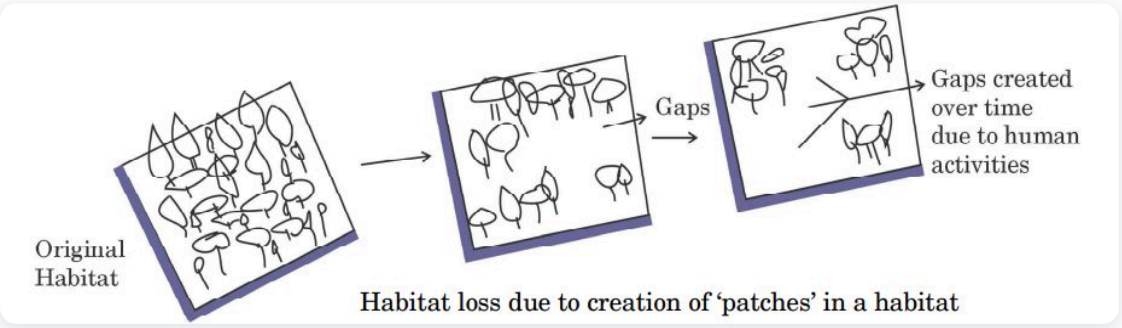
Question 26.

Given below is a picture of a natural large habitat that is being continuously broken into smaller patches. This process is continuing, increasing and expanding over time due to human impact, thereby posing a great risk to the existence of species in the habitat.

(a) Do you agree with the above statement ? Give two suitable reasons in support of your answer.

(b) Write the ecological term used for such patches formed in an original habitat.

[3 Marks]



Habitat loss due to creation of 'patches' in a habitat

Answer: I agree with the statement that the fragmentation of a natural habitat poses significant risks to species' existence. Firstly, habitat fragmentation reduces the size of habitats available for wildlife, isolating populations and making it difficult for them to find mates and resources, ultimately leading to decreased genetic diversity and increased extinction risk. Secondly, smaller habitat patches often lead to edge effects, which can expose species to increased predation and competition, further threatening their survival. The ecological term for such smaller patches is 'habitat fragments.'

Key Points: Habitat fragmentation risks species' existence; Isolation limits mating and resource access; Decreased genetic diversity increases extinction risk; Edge effects increase predation and competition; Ecological term is habitat fragments.

Question 27.

An application of biotechnology in agriculture involves production of pest resistant plants using 'cry' genes from a bacterium. Name the bacterium. Explain why the 'cry' gene kills the pest but not the bacterium itself.

[3 Marks]

Answer: The bacterium is Bacillus thuringiensis (Bt). The 'cry' gene produces a protein that is toxic to certain insects but is harmless to humans and other non-target organisms. When pests ingest the cry protein, it gets activated in their alkaline gut environment, forming crystals that disrupt their digestive system. This process leads to the death of the pest. On the contrary, the bacterium itself has a different gut environment, preventing the protein from being activated, thus allowing it to survive while targeting only specific pests.

Key Points: Bacillus thuringiensis (Bt)-'cry' gene produces toxic protein-insects activate the protein in their gut-cause digestive disruption-bacterium survives due to different gut pH.

Section E

Question 28.

Describe the process of fertilization and implantation in humans.

[5 Marks]

Answer: Fertilization in humans begins during copulation when semen is ejaculated into the vagina, allowing motile sperm to swim through the cervix and into the uterus towards the fallopian tubes, where the ovum is usually located. Upon reaching the ovum, a sperm penetrates the zona pellucida, triggering changes that prevent other sperm from entering. This fusion creates a zygote, which then travels down the fallopian tube, undergoing division. Once the blastocyst forms, it reaches the uterus and attaches to the endometrium, marking implantation. The trophoblast layer of the blastocyst embeds itself in the uterine lining, rapidly dividing the uterine cells to cover and nourish the developing embryo. This crucial step initiates pregnancy, ensuring the embryo is securely established for further development.

Key Points: Copulation leads to insemination; sperm swim through vagina, cervix to uterus; fertilization occurs when sperm penetrates ovum; zygote formation; blastocyst formation during journey through fallopian tube; implantation into the endometrium; trophoblast layer involved in embedding and nourishment.

Question 29.

Describe the process of sexual reproduction in flowering plants.

[5 Marks]

Answer: Sexual reproduction in flowering plants involves several stages that facilitate the formation of fruits and seeds. The process begins with pollination, where pollen grains from the anthers of one flower are transferred to the stigma of the same or another flower. This is facilitated by various agents such as wind, water, and animals, which aid in cross-pollination. Once on the stigma, the pollen germinates and forms a pollen tube that grows down the style to the ovary, containing ovules. Fertilization occurs when male gametes travel through the pollen tube to fuse with the female gametes in the ovule, resulting in the formation of a zygote. Following fertilization, the zygote develops into an embryo within the seed. The ovary develops into a fruit, protecting the seeds and aiding in their dispersal. Throughout this process, flowers exhibit diverse structures and adaptations that enhance reproductive success, ensuring genetic diversity among flowering plants. This entire mechanism highlights not only the beauty and complexity of flowering plants but also their crucial role in maintaining ecosystem balance through sexual reproduction.

Key Points: 1. Pollination methods: self-pollination vs cross-pollination. 2. Role of pollen tube in fertilization. 3. Development of seeds and fruits post-fertilization. 4. Structural adaptations of flowers for enhancing reproduction. 5. Importance of genetic diversity in flowering plants.

Question 30.

Describe the menstrual cycle and its hormonal regulation

[5 Marks]

Answer: The menstrual cycle is a vital reproductive process in human females, typically lasting about 28 days. It begins with the menstrual phase, which lasts for 3-5 days, where the endometrium disintegrates, leading to menstruation. This marks the start of a new cycle. The cycle involves four main phases: the menstrual phase, follicular phase, ovulation, and luteal phase. Hormones play a crucial role in regulating these phases. The cycle begins with low levels of estrogen and progesterone, allowing the hypothalamus to release gonadotropin-releasing hormone (GnRH), which stimulates the pituitary gland to secrete follicle-stimulating hormone (FSH). FSH promotes the growth of ovarian follicles, leading to increased estrogen production, which triggers the thickening of the endometrium. Around the middle of the cycle, a surge in luteinizing hormone (LH) leads to ovulation—the release of

an ovum. Following ovulation, the luteal phase begins; the remnants of the follicle form the corpus luteum, which secretes progesterone. This hormone further prepares the endometrium for possible implantation of an embryo. If fertilization does not occur, progesterone levels drop, leading to the disintegration of the endometrium and the commencement of menstruation, thus repeating the cycle. This cyclic process continues until menopause, around age 50.

Key Points: menstrual cycle phases (menstrual, follicular, ovulation, luteal) - hormonal regulation by GnRH, FSH, LH, estrogen, progesterone - average cycle length of 28 days - ovulation occurs mid-cycle - menstrual flow indicates endometrial disintegration - menopause marks the end of the cycle