UP Board Biology - 348 (KH) - 2025 Question Paper with Solutions

Time Allowed :3 Hours	**Maximum Marks :**70	**Total questions :**35

General Instructions

Instruction:

i) *All* questions are compulsory. Marks allotted to each question are given in the margin.

ii) In numerical questions, give all the steps of calculation.

iii) Give relevant answers to the questions.

iv) Give chemical equations, wherever necessary.

Q1(a). Tt alleles are pair of:

(A) Homozygous long

(B) Heterozygous long

(C) Homozygous dwarf

(D) Heterozygous dwarf

Correct Answer: (D) Heterozygous dwarf

Solution:

Step 1: Understanding the alleles.

The alleles T and t represent the traits for the plant. The capital letter T usually represents the dominant trait (long), and the lowercase t represents the recessive trait (dwarf).

Step 2: Determine the type of pair.

The combination of one capital T and one lowercase t results in a heterozygous combination (Tt), with T being dominant. Hence, the correct description is ”Heterozygous dwarf.”

Final Answer:

$$\boxed{(D)\ Heterozygous\ dwarf}$$

Quick Tip

In genetics, the combination of different alleles results in heterozygous, while identical alleles form homozygous pairs.

Q1(b). Bt cotton formed from:

(A) Virus

(B) Fungi

(C) Bacteria

(D) Insects

Correct Answer: (C) Bacteria

Solution:

Step 1: Understanding Bt cotton.

Bt cotton is a genetically modified organism that produces its own insecticide. The modification involves inserting a gene from the bacterium Bacillus thuringiensis (Bt).

Step 2: Correct answer analysis.

Bt cotton is formed from the bacteria Bacillus thuringiensis, which helps the plant defend against pests.

Final Answer:

$$\boxed{(C)\ Bacteria}$$

Quick Tip

Bt cotton is an example of genetic engineering where a bacterium's gene is introduced to provide pest resistance.

Q1(c). Which one of the following is secondary consumer?

(A) Rat

(B) Squirrel

(C) Lizard

(D) Grasshopper

Correct Answer: (C) Lizard

Solution:

Step 1: Understand the concept of consumers.

- Primary consumers are herbivores, feeding on plants. - Secondary consumers are carnivores, feeding on primary consumers.

Step 2: Identify the secondary consumer.

- The rat (A) and squirrel (B) are primary consumers because they eat plants. - The grasshopper (D) is also a primary consumer (herbivore). - The lizard (C) is a secondary consumer because it feeds on insects (primary consumers).

Final Answer:

$$\boxed{(C)\ Lizard}$$

Quick Tip

Secondary consumers feed on primary consumers (herbivores), and they are typically carnivores or omnivores.

Q1(d). Which one of the following is not a cause of loss of biodiversity?

(A) Over exploitation

(B) Co-extinction

(C) Habitat loss

(D) Forestation

Correct Answer: (D) Forestation

Solution:

Step 1: Understand the causes of biodiversity loss.

- Over exploitation (A) leads to depletion of species due to excessive hunting or harvesting. - Co-extinction (B) occurs when one species goes extinct, leading to the extinction of others dependent on it. - Habitat loss (C) is the destruction or alteration of habitats, leading to a decline in biodiversity.

Step 2: Analyze forestation.

- Forestation (D), which refers to the creation of new forests, is not a cause of biodiversity loss. In fact, it can help increase biodiversity by providing new habitats.

Final Answer:

$$\boxed{(D)\ Forestation}$$

Quick Tip

Forestation helps in conservation by creating new habitats, unlike habitat destruction, which leads to loss of biodiversity.

Q2(a). Write the full form of abbreviation I.V.F.

Solution:

Step 1: Understand the term I.V.F.

I.V.F. stands for In Vitro Fertilization, which is a medical procedure used to help individuals with fertility problems. It involves the fertilization of an egg outside the human body.

Step 2: Procedure of I.V.F.

The procedure includes stimulating the ovaries to produce multiple eggs, collecting the eggs, and then fertilizing them with sperm in a laboratory dish. The fertilized eggs (embryos) are then implanted into the uterus.

Step 3: Significance of I.V.F.

I.V.F. has helped many couples achieve pregnancy when other methods fail, such as in cases of blocked fallopian tubes, male infertility, or unexplained infertility.

Final Answer:

$$\boxed{\text{In Vitro Fertilization}}$$

Quick Tip

I.V.F. is one of the most widely known assisted reproductive technologies, used in cases of infertility where traditional methods fail.

Q2(b). Write the name of the indicator of industrial pollution.

Solution:

Step 1: Define the term ”bioindicator”.

Bioindicators are organisms or substances used to monitor the health of an environment. They respond to environmental changes, especially pollution, and can help us assess the quality of air, water, and soil.

Step 2: Role of Lichens in Pollution Monitoring

Lichens are excellent bioindicators of air quality. They are sensitive to sulfur dioxide, nitrogen oxides, and other pollutants, making them good indicators of industrial pollution.

Step 3: Why Lichens are Ideal Bioindicators

Lichens do not have a protective cuticle, so pollutants can directly affect them. Their presence or absence, as well as their species diversity, can reveal the level of air pollution in an area.

Final Answer:

Lichens

Quick Tip

Lichens are more sensitive to air pollution than many other organisms, making them valuable bioindicators in ecological studies.

Q2(c). What is nucleoside?

Solution:

Step 1: Understand the structure of a nucleoside.

A nucleoside is made up of two components: 1. A nitrogenous base: This can be a purine (adenine or guanine) or a pyrimidine (cytosine, thymine, or uracil). 2. A sugar: This can either be ribose (in RNA) or deoxyribose (in DNA).

Step 2: Difference between nucleosides and nucleotides.

A nucleoside consists of the nitrogenous base and sugar, while a nucleotide also includes a phosphate group. The phosphate group is what distinguishes a nucleotide from a nucleoside.

Step 3: Examples of nucleosides.

- Adenosine (Adenine + Ribose) - Guanosine (Guanine + Ribose) - Thymidine (Thymine + Deoxyribose)

Final Answer:

A nucleoside is a compound consisting of a nitrogenous base and a sugar molecule without a phosphate

Quick Tip

Nucleosides are precursors to nucleotides, which are the building blocks of nucleic acids such as DNA and RNA.

Q2(d). How much percentage of energy passes from one trophic level to another trophic level?

Solution:

Step 1: Energy transfer in ecosystems.

In an ecosystem, energy flows from one trophic level to the next. However, the transfer is inefficient. Only a small fraction of energy is passed on at each trophic level.

Step 2: The 10% Rule.

The ”10% Rule” in ecology states that only about 10% of the energy from one trophic level is passed on to the next level. The rest is lost as heat, used for metabolic processes, or consumed in the form of waste.

Step 3: Ecological pyramids.

This energy loss is why the number of organisms decreases as you move up the trophic levels. Higher trophic levels, such as apex predators, have less available energy than lower levels like primary producers.

Final Answer:

$$\boxed{10\%}$$

Quick Tip

The 10% energy transfer rule helps explain the pyramid-shaped structure of ecosystems, with more energy available at the base and less at the top.

Q2(e). Write the name of any one sex-linked recessive disorder.

Solution:

Step 1: Understand sex-linked disorders.

Sex-linked recessive disorders are carried on the X chromosome. Since males have only one X chromosome, they are more likely to express these disorders if they inherit the defective gene.

Step 2: Example of a sex-linked recessive disorder.

One common sex-linked recessive disorder is **hemophilia**, a condition that impairs the blood's ability to clot, leading to excessive bleeding. This disorder is more common in males.

Step 3: Inheritance of hemophilia.

Females can be carriers of hemophilia if they inherit one defective X chromosome, but males who inherit the defective X chromosome will express the disorder.

Final Answer:

$$\boxed{\text{Hemophilia}}$$

Quick Tip

Hemophilia is inherited in an X-linked recessive manner, making it more prevalent in males than in females.

Q3(a). Write a short note on Humus.

Solution:

Step 1: Define Humus

Humus is the dark, organic material formed in soil when plants and animals decay. It is rich in essential nutrients like nitrogen, phosphorus, and potassium.

Step 2: Function of Humus

It helps improve soil structure, retains moisture, and promotes the growth of beneficial microorganisms. Humus is a key component for enhancing soil fertility.

Final Answer: Humus is the decomposed organic material in soil that enhances soil fertility by providing essential nutrients and improving soil structure.

Quick Tip

Humus plays a critical role in maintaining soil health and fertility.

Q3(b). Describe exponential growth.

Solution:

Step 1: Define Exponential Growth

Exponential growth occurs when the growth rate of a population is proportional to its current size. This type of growth follows a mathematical model given by the equation:

$$N(t) = N_0 e^{rt}$$

where: - $N(t)$ is the population at time t - N_0 is the initial population - r is the growth rate - t is time

Step 2: Characteristics of Exponential Growth

Exponential growth leads to a rapid increase in the number of individuals in a population. For example, bacteria or viruses may exhibit exponential growth in favorable conditions.

Step 3: Real-World Example

In ecology, exponential growth is often observed in species that face no constraints such as limited resources.

Final Answer: Exponential growth is a process where the rate of change is proportional to the current population, leading to rapid, continuous growth over time.

Quick Tip

Exponential growth can continue unchecked only when resources are unlimited.

Q3(c). What is antitoxin?

Solution:

Step 1: Define Antitoxin

An antitoxin is a substance, typically an antibody, that neutralizes toxins produced by bacteria or other harmful organisms in the body. These toxins can cause harm to the cells and tissues.

Step 2: Role of Antitoxin

Antitoxins bind to the toxin molecules, preventing them from entering cells or damaging tissues. They are produced by the immune system in response to infections.

Final Answer: Antitoxins are antibodies that neutralize harmful toxins produced by bacteria and prevent them from causing cellular damage.

Quick Tip

Antitoxins are a vital part of the immune response to bacterial infections.

Q3(d). What is the number of chromosomes in a female honeybee? What is sex determination system called in them?

Solution:

Step 1: Number of Chromosomes in Female Honeybee

A female honeybee has 32 chromosomes. These include 16 pairs of autosomes and 1 pair of sex chromosomes.

Step 2: Sex Determination in Honeybees

The sex determination system in honeybees is called the haplodiploid system. Females are diploid (2n) with two sets of chromosomes, while males are haploid (1n) with only one set.

Final Answer: A female honeybee has 32 chromosomes, and the sex determination system in honeybees is called the haplodiploid system.

Quick Tip

In honeybees, males develop from unfertilized eggs and are haploid, while females develop from fertilized eggs and are diploid.

Q3(e). Write two characteristics of genetic code.

Solution:

Step 1: Universality of Genetic Code

The genetic code is universal, meaning that it is the same across all living organisms, from bacteria to humans. This ensures that the same set of codons produces the same amino acids across species.

Step 2: Redundancy of Genetic Code

The genetic code is redundant, meaning that multiple codons can encode the same amino acid. For example, both UUU and UUC codons specify the amino acid phenylalanine.

Final Answer: Two characteristics of the genetic code are: 1. Universality 2. Redundancy

Quick Tip

The redundancy of the genetic code helps reduce the impact of mutations.

Q4(a). Write the name of all types of RNA found in prokaryotes.

Solution:

Step 1: Types of RNA in Prokaryotes

In prokaryotes, three main types of RNA are involved in protein synthesis:

1. **mRNA (Messenger RNA)** - Carries genetic information from DNA to the ribosome for protein synthesis. 2. **tRNA (Transfer RNA)** - Brings amino acids to the ribosome, matching the codons on mRNA with the appropriate amino acids. 3. **rRNA (Ribosomal RNA)** - Combines with proteins to form the ribosome, where protein synthesis occurs.

Final Answer: The three types of RNA found in prokaryotes are mRNA, tRNA, and rRNA.

Quick Tip

In prokaryotes, the absence of a nucleus means transcription and translation occur simultaneously in the cytoplasm.

Q4(b). What is double fertilization? What is its importance?

Solution:

Step 1: Define Double Fertilization

Double fertilization is a process unique to angiosperms (flowering plants) where two fertilization events occur. One sperm cell fertilizes the egg cell, forming a zygote, while another sperm cell fuses with two polar nuclei, forming a triploid cell that develops into the endosperm (a tissue that provides nutrition to the developing embryo).

Step 2: Importance of Double Fertilization

1. **Formation of Zygote and Endosperm**: The zygote develops into the embryo, while the endosperm nourishes the developing embryo. 2. **Efficient Use of Resources**: Double fertilization ensures that the resources of the plant are used efficiently to support embryo growth.

Final Answer: Double fertilization is the fusion of one sperm cell with the egg and another with two polar nuclei. Its importance lies in forming both the zygote (embryo) and the endosperm (food source for the embryo).

Quick Tip

Double fertilization is unique to angiosperms and is critical for seed development.

Q4(c). Cannabinoids are obtained from which plant? Highlight its importance.

Solution:

Step 1: Plant Source of Cannabinoids

Cannabinoids are primarily obtained from the **Cannabis** plant, specifically from Cannabis sativa and Cannabis indica species.

Step 2: Importance of Cannabinoids

1. **Medicinal Uses**: Cannabinoids like THC and CBD are used in medicine to alleviate chronic pain, reduce inflammation, and treat conditions such as epilepsy and anxiety. 2.

Recreational Uses: THC is known for its psychoactive effects, commonly used recreationally.

Final Answer: Cannabinoids are obtained from the Cannabis plant, and their importance lies in their medicinal and recreational uses.

Quick Tip

Cannabinoids have therapeutic potential in treating various health conditions.

Q4(d). Write a note on Baker Yeast.

Solution:

Step 1: Define Baker Yeast

Baker's yeast, scientifically known as **Saccharomyces cerevisiae**, is a single-celled fungus commonly used in baking and brewing. It ferments sugars, producing carbon dioxide and alcohol.

Step 2: Uses of Baker Yeast

1. **Baking**: The carbon dioxide produced during fermentation causes dough to rise, making bread fluffy and light. 2. **Brewing**: Yeast is used to ferment sugars in brewing alcoholic beverages like beer and wine.

Step 3: Other Uses

Baker's yeast is also studied in research for its role in cellular processes and genetics.

Final Answer: Baker's yeast (Saccharomyces cerevisiae) is used in baking and brewing for fermentation, producing carbon dioxide and alcohol.

Quick Tip

Baker's yeast is essential for leavening in baking and is also used in the production of alcoholic beverages.

Q5(a). Write the full form of A.R.T. What is its importance in human life?

Solution:

Step 1: Full Form of A.R.T.

A.R.T. stands for **Assisted Reproductive Technology**.

Step 2: Importance of A.R.T. in Human Life

1. **Infertility Treatment**: A.R.T. helps couples who are unable to conceive naturally due to infertility. It includes techniques like in vitro fertilization (IVF). 2. **Helps in Genetic Disorders**: It can be used for genetic screening to prevent transmission of hereditary diseases. 3. **Enables Single Parenthood**: It offers options for single individuals or same-sex couples to have biological children through sperm or egg donation.

Final Answer: The full form of A.R.T. is Assisted Reproductive Technology. Its importance lies in treating infertility, preventing genetic disorders, and enabling single parenthood or same-sex couples to have children.

Quick Tip

A.R.T. has revolutionized reproductive medicine and offers solutions to many fertility issues.

Q5(b). Differentiate between co-dominance and incomplete dominance.

Solution:

Step 1: Definition of Co-Dominance

Co-dominance occurs when both alleles contribute equally and visibly to the organism's phenotype. For example, in the case of blood type, the alleles A and B are co-dominant, both being expressed in the heterozygote.

Step 2: Definition of Incomplete Dominance

Incomplete dominance occurs when neither allele is fully dominant over the other, leading to a blending of traits in the offspring. For example, when a red flower (RR) is crossed with a white flower (WW), the offspring may be pink (RW), a mixture of the two.

Step 3: Key Differences

- **Co-dominance**: Both alleles are expressed equally in the phenotype (e.g., AB blood type). - **Incomplete Dominance**: The phenotype is a blend of the two alleles (e.g., pink flowers from red and white parents).

Final Answer: In co-dominance, both alleles are expressed equally, while in incomplete dominance, the alleles blend to form an intermediate phenotype.

Quick Tip

In co-dominance, both traits are fully visible, while in incomplete dominance, the traits mix.

Q5(c). Write the complete form of G.M.O. Highlight its importance.

Solution:

Step 1: Complete Form of G.M.O.

The complete form of G.M.O. is **Genetically Modified Organism**.

Step 2: Importance of G.M.O.

1. **Increased Crop Yield**: G.M.O. crops can be engineered to resist pests, diseases, or extreme environmental conditions, increasing crop yields. 2. **Enhanced Nutritional Value**: Some G.M.O. foods are engineered to have enhanced nutritional profiles, such as golden rice which is rich in Vitamin A. 3. **Reduced Need for Pesticides**: Certain genetically modified crops are resistant to herbicides and pests, reducing the need for chemical pesticides.

Final Answer: The complete form of G.M.O. is Genetically Modified Organism. Its importance includes increased crop yield, enhanced nutrition, and reduced pesticide use.

Quick Tip

G.M.O.s can help address food security issues and improve the nutritional content of crops.

Q5(d). Write a note on cloning vectors.

Solution:

Step 1: Define Cloning Vectors

Cloning vectors are DNA molecules used to transfer foreign genetic material into a host cell. They are essential tools in genetic engineering and molecular biology.

Step 2: Types of Cloning Vectors

1. **Plasmids**: Small, circular DNA molecules found in bacteria, often used for cloning purposes. 2. **Bacteriophages**: Viruses that infect bacteria and can be used as vectors to introduce foreign DNA into bacteria. 3. **Cosmids**: Hybrid vectors containing characteristics of plasmids and bacteriophages, used to clone larger DNA fragments.

Step 3: Role of Cloning Vectors

Cloning vectors facilitate the cloning of genes, gene expression studies, and protein production in biotechnology applications.

Final Answer: Cloning vectors, such as plasmids, bacteriophages, and cosmids, are DNA molecules used to introduce foreign DNA into host cells for gene cloning and biotechnology applications.

Quick Tip

Cloning vectors are crucial for gene manipulation, helping to clone, express, and study genes in laboratory settings.

Q6(a). Give a short introduction of any two drugs.

Solution:

Step 1: Drug 1 - Aspirin

Aspirin, or acetylsalicylic acid, is a widely used anti-inflammatory drug that reduces fever, pain, and inflammation. It works by inhibiting enzymes (COX-1 and COX-2) responsible for the formation of prostaglandins, which mediate pain and inflammation. It is commonly used for headaches, arthritis, and cardiovascular protection.

Step 2: Drug 2 - Penicillin

Penicillin is an antibiotic derived from fungi that is used to treat bacterial infections. It works by inhibiting bacterial cell wall synthesis, leading to the destruction of bacteria. Penicillin is effective against a variety of bacterial infections, including respiratory and skin infections.

Final Answer: 1. Aspirin is used for pain relief and inflammation. 2. Penicillin is an antibiotic used to treat bacterial infections.

Quick Tip

Always use drugs as prescribed and consult a doctor for appropriate usage.

Q6(b). Write the importance of species diversity in an ecosystem.

Solution:

Step 1: Definition of Species Diversity

Species diversity refers to the variety of species present in an ecosystem, encompassing both the number of species (species richness) and their relative abundance (species evenness).

Step 2: Importance of Species Diversity

1. **Ecosystem Stability**: High species diversity contributes to the resilience of an ecosystem, allowing it to recover from disturbances such as droughts or floods. 2. **Resource Use Efficiency**: Diverse species use resources in different ways, making the ecosystem more efficient in terms of energy and nutrient cycling. 3. **Enhanced Ecosystem Services**: Species diversity supports the production of ecosystem services like pollination, water purification, and carbon sequestration, which are vital for human survival.

Final Answer: Species diversity ensures ecosystem stability, enhances resource use efficiency, and supports vital ecosystem services.

Quick Tip

Maintaining species diversity is crucial for ecosystem health and human well-being.

Q6(c). Write a note on the effect of alcohol.

Solution:

Step 1: Effects of Alcohol on the Body

Alcohol is a depressant that affects the central nervous system. Its immediate effects include relaxation, lowered inhibitions, and impaired judgment. In larger quantities, alcohol slows down brain activity, leading to drowsiness and impaired motor coordination.

Step 2: Long-Term Effects of Alcohol

Chronic alcohol consumption can lead to liver damage (cirrhosis), heart disease, and neurological disorders. It can also contribute to mental health issues like depression and anxiety. Excessive alcohol consumption increases the risk of addiction and other health complications.

Final Answer: Alcohol acts as a depressant, affecting the central nervous system. Chronic use can lead to severe health complications like liver damage, heart disease, and addiction.

Quick Tip

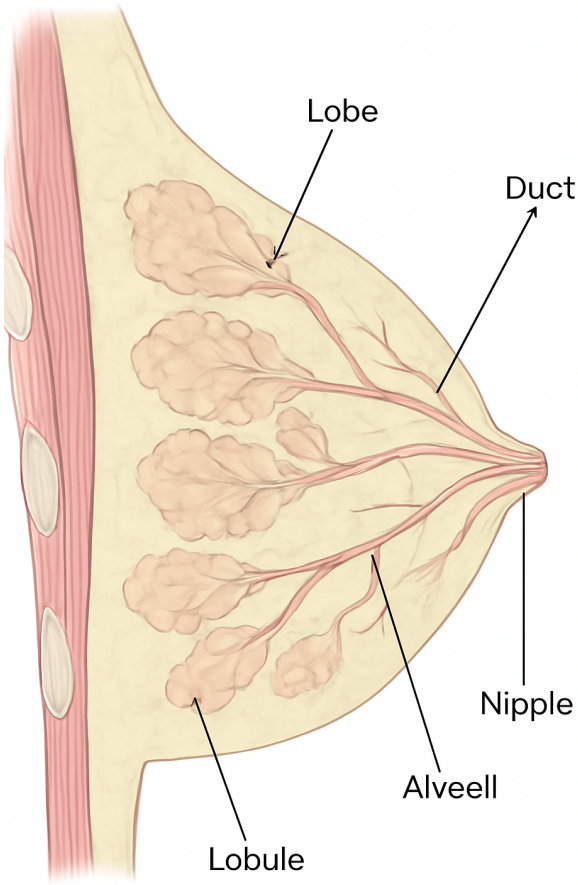
Moderation is key when consuming alcohol to avoid long-term health risks.

Q6(d). Draw a labelled diagram of the sectional view of the mammary gland.

Solution:

Step 1: Overview of Mammary Gland Structure

The mammary gland is a modified sweat gland that produces milk in female mammals. It consists of lobes, lobules, ducts, and alveoli, which work together to produce and release milk.



The diagram above illustrates the sectional view of the mammary gland, including its key components such as lobes, lobules, and ducts, which are responsible for milk production and secretion.

Quick Tip

Mammary glands are critical for lactation and nourishing offspring after birth.

Q7. What is Pollination? How many types of pollination are there? Describe with examples.

Solution:

Step 1: Define Pollination.

Pollination is the process in which pollen is transferred from the male anther of a flower to the female stigma for fertilization to occur. This is a vital part of plant reproduction and seed

production.

Step 2: Types of Pollination.

There are two main types of pollination:

1. **Self-Pollination:** Self-pollination occurs when pollen from the same plant or flower reaches the stigma. Examples include pea plants and wheat.
2. **Cross-Pollination:** Cross-pollination happens when pollen from one flower is transferred to another flower on a different plant of the same species. This type of pollination is facilitated by agents such as wind, insects, birds, or animals. Examples include sunflower and apple trees.

Final Answer: Pollination is the transfer of pollen from male to female parts of a plant, and it occurs in two forms: self-pollination and cross-pollination.

Quick Tip

Pollination plays a key role in the genetic diversity of plants. Cross-pollination increases variability, which can help plants adapt to changing environmental conditions.

OR

Q7. What is the Menstrual cycle? Describe its main steps.

Solution:

Step 1: Define Menstrual Cycle.

The menstrual cycle refers to the series of changes in a woman's body that prepare it for a possible pregnancy. It lasts about 28 days but can range from 21 to 35 days. The cycle includes hormonal changes that lead to ovulation and menstruation.

Step 2: Main Steps of the Menstrual Cycle.

The menstrual cycle consists of the following phases:

1. **Menstrual Phase:** This phase starts with menstruation, where the uterine lining is shed. This phase typically lasts for 3-7 days.

2. **Follicular Phase:** The follicular phase begins after menstruation and involves the development of follicles in the ovaries under the influence of FSH (Follicle Stimulating Hormone). It lasts around 10-14 days.
3. **Ovulation:** Ovulation occurs around the middle of the cycle when a mature egg is released from the ovary into the fallopian tube. This is triggered by the surge in LH (Luteinizing Hormone).
4. **Luteal Phase:** Following ovulation, the luteal phase begins. The ruptured follicle forms the corpus luteum, which secretes progesterone to prepare the uterus for pregnancy. If no pregnancy occurs, the corpus luteum breaks down, leading to the next menstrual cycle.

Final Answer: The menstrual cycle consists of four main phases: menstrual, follicular, ovulation, and luteal. These phases regulate hormonal changes and prepare the body for pregnancy.

Quick Tip

Tracking the menstrual cycle helps in understanding fertility patterns and reproductive health. It can be helpful for monitoring the timing of ovulation or identifying irregularities.

Q.8: Write an essay on evidence for evolution of life on Earth.

Solution:

Introduction: Evolution is the process by which species of organisms undergo change over time through natural selection, genetic mutations, and other mechanisms. Evidence for evolution has been collected over centuries from various scientific disciplines including paleontology, genetics, embryology, comparative anatomy, and molecular biology. This essay discusses the different lines of evidence supporting the theory of evolution.

Fossil Evidence: One of the strongest pieces of evidence for evolution comes from the fossil record. Fossils, which are the remains or impressions of organisms preserved in rock,

provide a chronological record of life on Earth. The succession of fossilized organisms found in the Earth's layers indicates how species have evolved over time. Fossils show transitional forms, such as the archaeopteryx, which represents an intermediate form between dinosaurs and birds.

Comparative Anatomy: Another important line of evidence for evolution is comparative anatomy. This field compares the structures of different species and identifies similarities and differences. Homologous structures, like the forelimbs of humans, whales, and bats, are anatomical features that have a common origin but have evolved to perform different functions. This suggests that these species share a common ancestor.

Genetic Evidence: In the modern era, genetics has provided direct evidence of evolution. The similarities in the genetic code among all living organisms indicate a common origin. For example, humans and chimpanzees share about 98% of their DNA, providing evidence of a recent common ancestor. Furthermore, genetic mutations and the variation in gene frequencies within populations drive the process of evolution.

Embryological Evidence: Embryology, the study of the development of embryos, also supports evolutionary theory. Early embryos of different vertebrates, such as fish, birds, and mammals, exhibit similar features, such as gill slits and tails, at certain stages of development. These similarities suggest that these species have a common evolutionary origin.

Biogeography: The study of the geographic distribution of species also provides evidence for evolution. Species that are geographically isolated, such as those on islands, often evolve into distinct species adapted to their specific environments. The finches on the Galápagos Islands, which played a significant role in Charles Darwin's development of the theory of natural selection, are an example of adaptive radiation in response to different ecological niches.

Experimental Evidence: Evolutionary processes have been observed in real-time in laboratory settings and the natural world. The development of antibiotic resistance in bacteria is a well-documented example of natural selection in action. Similarly, the peppered

moth in England underwent a shift in coloration during the Industrial Revolution due to pollution, providing an observable example of evolutionary change.

Conclusion: The theory of evolution is supported by multiple lines of evidence from various scientific fields. Fossils, comparative anatomy, genetics, embryology, biogeography, and experimental data all converge to support the idea that life on Earth has evolved over billions of years. Understanding evolution is fundamental to understanding the diversity of life and the processes that have shaped the living world.

Final Answer:

$Evidence for evolution includes fossil records, comparative anatomy, genetic analysis, embryology, biogeog$

Quick Tip

Evolution is a gradual process that has been occurring for millions of years, driven by natural selection, mutations, and genetic variations.

Or

Q.8: Describe lac-operon with diagram.

Solution:

Introduction: The lac operon is a set of genes in *E. coli* that is involved in the metabolism of lactose. It is one of the most studied examples of gene regulation in prokaryotes. The operon consists of three structural genes, a promoter, an operator, and a regulator gene. The lac operon is an example of inducible gene expression.

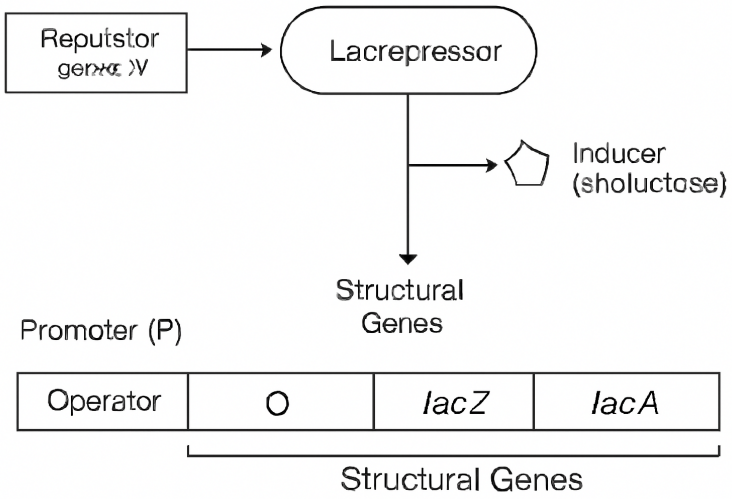
Components of the Lac Operon: 1. **Structural Genes:** - **lacZ**: Encodes the enzyme β-galactosidase, which breaks down lactose into glucose and galactose. - **lacY**: Encodes permease, a membrane protein that facilitates the entry of lactose into the cell. - **lacA**: Encodes transacetylase, an enzyme involved in the detoxification of by-products during lactose metabolism.

2. **Regulatory Region:** - **Promoter (P):** The site where RNA polymerase binds to initiate transcription. - **Operator (O):** The region where the lac repressor protein binds to

prevent transcription. - **Regulator gene (I):** Codes for the lac repressor, which binds to the operator in the absence of lactose to inhibit transcription.
3. **Inducer (Allolactose):** Allolactose, a metabolite of lactose, is the inducer that inactivates the lac repressor by binding to it. This allows RNA polymerase to bind to the promoter and transcribe the lac genes.

Regulation of the Lac Operon: The lac operon is under negative control. In the absence of lactose, the repressor protein binds to the operator, preventing the transcription of the lac genes. When lactose is present, allolactose binds to the repressor, causing a conformational change that prevents the repressor from binding to the operator. This allows RNA polymerase to transcribe the operon, enabling the metabolism of lactose.

Diagram: Below is a diagram of the lac operon showing its components and the regulatory mechanism:



Conclusion: The lac operon is a well-understood model of gene regulation that exemplifies how bacteria can regulate gene expression in response to environmental changes. It allows *E. coli* to efficiently metabolize lactose only when it is available, conserving energy by avoiding unnecessary production of enzymes when lactose is absent.

Final Answer:

$$Lacoperonconsistsofgeneslac Z, lacY, andlacA, withapromoter, operator, andrepressorsystemforgenere$$

Quick Tip

The lac operon is an example of an inducible operon, where the presence of an inducer (lactose) promotes gene expression.

Q9. Describe the components of a water ecosystem in detail.

Solution:

A water ecosystem consists of several interrelated components that interact with each other. These components are:

1. Abiotic Components: These are the non-living physical and chemical factors in an ecosystem. They include: - **Water:** The most essential component of any aquatic ecosystem. The quality, depth, and temperature of water significantly influence the ecosystem's health. - **Light:** Sunlight is the primary source of energy for photosynthetic organisms in the ecosystem. - **Temperature:** Water temperature affects the metabolic rate of organisms. Most aquatic organisms are adapted to specific temperature ranges. - **Minerals:** Various minerals like oxygen, nitrogen, carbon dioxide, and others play a critical role in sustaining life.

2. Biotic Components: These are the living organisms in the ecosystem and can be categorized as: - **Producers (Autotrophs):** These include phytoplankton, algae, and aquatic plants, which perform photosynthesis and produce organic material from sunlight. - **Consumers (Heterotrophs):** These organisms feed on other organisms. They are further divided into: - **Primary consumers (herbivores):** They feed on producers (e.g., zooplankton). - **Secondary consumers (carnivores):** They feed on primary consumers (e.g., fish). - **Tertiary consumers:** These organisms are apex predators (e.g., large predatory fish, birds). - **Decomposers:** These include bacteria and fungi, which break down dead organisms and organic material, returning nutrients to the ecosystem.

3. Human Influence: Human activities, including pollution, deforestation, and climate change, can significantly affect water ecosystems. Human interventions can either harm or help restore the health of these ecosystems.

4. Nutrient Cycling: In water ecosystems, nutrients like nitrogen and phosphorus cycle through various processes such as decomposition, absorption by plants, and consumption by

animals, helping maintain the balance and health of the ecosystem.

Final Answer: The components of a water ecosystem include abiotic factors (water, light, temperature, and minerals), biotic factors (producers, consumers, decomposers), and human influence. The healthy functioning of the ecosystem depends on the interactions between these components.

Quick Tip

A balanced water ecosystem relies on proper nutrient cycling, sufficient sunlight, and a healthy mix of producers and consumers.

Or

Q9. Write an essay on biodiversity conservation.

Solution:

Introduction: Biodiversity refers to the variety of life forms on Earth, encompassing all species of plants, animals, fungi, and microorganisms, and the ecosystems they inhabit. It is the foundation of ecosystem health and resilience, providing essential services such as clean air, water, and food. However, biodiversity is rapidly declining due to human activities, and this has led to the need for biodiversity conservation.

Causes of Biodiversity Loss: 1. **Habitat Destruction:** Deforestation, urbanization, and industrialization destroy natural habitats, leaving species with no place to thrive. 2. **Climate Change:** Alterations in temperature and weather patterns disrupt ecosystems and species migration, making survival difficult for many organisms. 3. **Pollution:** Contaminants from industries, agriculture, and waste can poison air, water, and soil, endangering both aquatic and terrestrial species. 4. **Overexploitation:** Overfishing, hunting, and the illegal wildlife trade threaten species with extinction. 5. **Invasive Species:** Non-native species introduced into new habitats often outcompete or prey on native species, leading to their decline.

Importance of Biodiversity Conservation: 1. **Ecological Balance:** Biodiversity plays a crucial role in maintaining ecological balance. Different species perform vital roles such as pollination, seed dispersal, and maintaining the food chain. 2. **Economic Value:** Many

industries depend on biodiversity, including agriculture, pharmaceuticals, and tourism. The loss of biodiversity threatens these industries and the livelihoods they provide. 3. **Cultural and Aesthetic Value:** Many cultures revere biodiversity, and natural beauty is a significant source of inspiration, recreation, and spiritual significance.

Methods of Biodiversity Conservation: 1. **In-Situ Conservation:** This method involves protecting species within their natural habitats. Establishing national parks, wildlife sanctuaries, and biosphere reserves can help conserve ecosystems and species in their natural environment. 2. **Ex-Situ Conservation:** This involves conserving biodiversity outside natural habitats, such as through botanical gardens, zoos, seed banks, and gene banks. 3. **Sustainable Development:** Promoting practices that do not harm biodiversity, such as sustainable agriculture, eco-tourism, and renewable energy, helps balance human needs with environmental preservation. 4. **Legislation and Policy:** Enacting and enforcing laws to protect wildlife, control pollution, and prevent overexploitation is essential. International agreements like the Convention on Biological Diversity (CBD) guide efforts to conserve biodiversity globally. 5. **Public Awareness and Education:** Raising awareness about the importance of biodiversity and the steps individuals and communities can take to protect it can foster a culture of conservation.

Conclusion: Biodiversity conservation is critical for the survival of life on Earth, including humans. The accelerating loss of biodiversity threatens the stability of ecosystems, human health, and economic prosperity. It is imperative for governments, industries, and individuals to work together to implement strategies that preserve biodiversity for future generations.

Final Answer: The conservation of biodiversity is crucial for sustaining the health of our planet. Addressing the causes of biodiversity loss and implementing effective conservation strategies can help ensure that the natural world continues to thrive for generations to come.

Quick Tip

Conserving biodiversity is not just an environmental issue; it is essential for maintaining our economy, health, and quality of life.
