UP Board Biology - 348 (KM) - 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) The number of chromosomes found in maize is

(A) 22

(B) 20

(C) 46

(D) 45

Correct Answer: ((A) 22

Solution:

Step 1: Understanding Chromosome Count in Maize.

Maize (corn) has 20 chromosomes in its gametes, but the diploid number of chromosomes is 2n = 22. This is typical for maize, which is often used as a model organism in plant genetics.

Step 2: Conclusion.

Thus, the correct number of chromosomes in maize is 22.

Final Answer:

$$\boxed{22 \text{ chromosomes in maize.}}$$

Quick Tip

Chromosome number varies widely across species, and the diploid number is typically 2n.

Q1(b). In Klinefelter syndrome, the number of sex chromosomes is:

(A) XXY

(B) XYO

(C) XYY

(D) XXX

Correct Answer: ((A) XXY

Solution:

Step 1: Klinefelter Syndrome Overview.

Klinefelter syndrome is a genetic condition that affects males, where they have one extra X chromosome. The typical male karyotype is XY, but individuals with Klinefelter syndrome have XXY.

Step 2: Conclusion.

Thus, the correct number of sex chromosomes in Klinefelter syndrome is XXY.

Final Answer:

XXY sex chromosomes in Klinefelter syndrome.

Quick Tip

Klinefelter syndrome is associated with an extra X chromosome, leading to XXY instead of the usual XY.

Q1(c). Suitable vector for cloning in plant cells is:

(A) SV40

(B) Ti plasmid

(C) pUC

(D) pBR322

Correct Answer: ((B) Ti plasmid

Solution:

Step 1: Ti Plasmid in Plant Cloning.

The Ti plasmid (Tumor Inducing plasmid) from the bacterium *Agrobacterium tumefaciens* is used as a vector for cloning in plant cells. It is specifically used to transfer foreign DNA into plant cells.

Step 2: Conclusion.

Thus, the correct vector for cloning in plant cells is the Ti plasmid.

Final Answer:

Ti plasmid is the suitable vector for cloning in plant cells.

Quick Tip

Ti plasmids are widely used for genetic modification in plants, especially in transgenic research.

Q1(d). Which of the following is a property of population?

(A) Mortality rate

(B) Birth rate

(C) Density

(D) All of these

Correct Answer: ((D) All of these

Solution:

Step 1: Properties of Population.

Properties of a population include factors that influence its growth and structure: 1. **Mortality rate**: The rate at which individuals die in a population. 2. **Birth rate**: The rate at which new individuals are born into the population. 3. **Density**: The number of individuals per unit area or volume.

All these properties contribute to understanding population dynamics and structure.

Step 2: Conclusion.

Thus, all of the listed factors—mortality rate, birth rate, and density—are properties of a population.

Final Answer:

All of these are properties of population.

Quick Tip

Population properties like birth rate, mortality rate, and density are essential for studying ecosystem dynamics.

Q2. a) What is the function of Leydig cells?

Solution:

Step 1: Understanding Leydig Cells.

Leydig cells, located in the interstitial spaces of the testes, are responsible for producing testosterone, the primary male sex hormone. Testosterone plays a key role in male sexual development, including the development of secondary sexual characteristics such as deepening of the voice and facial hair, as well as promoting spermatogenesis.

Step 2: Conclusion.

Thus, the function of Leydig cells is to produce testosterone.

Final Answer:

Leydig cells produce testosterone.

Quick Tip

Leydig cells are crucial for male reproductive health and the development of male sexual characteristics.

Q2. b) Cocaine is obtained from which plant?

Solution:

Step 1: Source of Cocaine.

Cocaine is an alkaloid drug obtained from the leaves of the *Erythroxylum coca* plant, commonly known as the coca plant. The leaves are harvested, and cocaine is extracted from them.

Step 2: Conclusion.

Therefore, cocaine is derived from the *Erythroxylum coca* plant.

Final Answer:

Cocaine is obtained from the *Erythroxylum coca* plant.

Quick Tip

Cocaine is a highly addictive drug, and its use is restricted or illegal in many countries.

Q2. c) What is the unit of heredity?

Solution:

Step 1: Definition of Heredity.

The unit of heredity is the **gene**. A gene is a segment of DNA that carries genetic information for the inheritance of traits. Genes are located on chromosomes and determine characteristics passed from parents to offspring.

Step 2: Conclusion.

Thus, the gene is the basic unit of heredity.

Final Answer:

The gene is the unit of heredity.

Quick Tip

Genes determine traits and are inherited across generations. They are composed of DNA and located on chromosomes.

Q2. d) Who gave the double helical model of DNA?

Solution:

Step 1: Watson and Crick's Contribution.

The double helical model of DNA was proposed by **James Watson** and **Francis Crick** in 1953. Their work was based on X-ray diffraction images produced by **Rosalind Franklin**, which helped them deduce the structure of DNA as two intertwined strands forming a double helix.

Step 2: Conclusion.

Thus, the double helical model of DNA was given by Watson and Crick.

Final Answer:

Watson and Crick proposed the double helical model of DNA.

Quick Tip

The discovery of DNA's double helix structure was crucial to understanding genetics and molecular biology.

Q2. e) Unfertilized egg develops in which form of honeybee?

Solution:

Step 1: Honeybee Reproduction.

In honeybees, unfertilized eggs develop into **drones**, which are male bees. This process is known as parthenogenesis, where the egg develops without fertilization. Drones are haploid, meaning they have only one set of chromosomes.

Step 2: Conclusion.

Thus, unfertilized eggs in honeybees develop into male drones.

Final Answer:

Unfertilized eggs in honeybees develop into drones (males).

Quick Tip

Parthenogenesis in honeybees results in the production of males (drones) from unfertilized eggs.

Q3. a) Differentiate between purine and pyrimidine bases.

Solution:

Step 1: Definition of Purine Bases.

Purines are nitrogenous bases that consist of a two-ring structure. The two main purines in nucleic acids are: 1. **Adenine (A)** 2. **Guanine (G)**

Step 2: Definition of Pyrimidine Bases.

Pyrimidines are nitrogenous bases that consist of a single ring structure. The three main pyrimidines in nucleic acids are: 1. **Cytosine (C)** 2. **Thymine (T)** (found in DNA) 3. **Uracil (U)** (found in RNA)

Step 3: Differences Between Purines and Pyrimidines.

1. **Structure**: Purines have a two-ring structure, while pyrimidines have a single-ring structure. 2. **Examples**: Purines include adenine and guanine; pyrimidines include cytosine, thymine, and uracil. 3. **Base Pairing**: Purines pair with pyrimidines to form base pairs in DNA and RNA (A pairs with T or U, G pairs with C).

Step 4: Conclusion.

Thus, purines and pyrimidines differ in their structure, with purines having a two-ring structure and pyrimidines a single-ring structure.

Final Answer:

Purines have a two-ring structure, while pyrimidines have a single-ring structure.

Quick Tip

Purines and pyrimidines are fundamental to the structure of nucleic acids and play a key role in genetic coding.

Q3. b) Write a note on Bt cotton.

Solution:

Step 1: Introduction to Bt Cotton.

Bt cotton is a genetically modified variety of cotton that has been engineered to produce a protein from the bacterium *Bacillus thuringiensis* (Bt). This protein acts as an insecticide, protecting the cotton plant from pests such as the cotton bollworm.

Step 2: Features of Bt Cotton.

1. **Genetic Modification**: Bt cotton has been modified by inserting a gene from *Bacillus thuringiensis*, which encodes the protein Cry, a toxin that kills specific pests. 2. **Insect Resistance**: The main advantage of Bt cotton is its built-in resistance to insect pests, reducing the need for chemical pesticides. 3. **Environmental Impact**: Bt cotton has led to a reduction in pesticide use, but concerns about resistance development in pests and the effect on non-target species have also been raised.

Step 3: Conclusion.

Bt cotton is an important genetically modified crop that offers pest resistance, but it also requires careful management to avoid resistance and other ecological concerns.

Final Answer:

Bt cotton is genetically modified to produce a toxin from *Bacillus thuringiensis* to protect against pes

Quick Tip

Bt cotton reduces pesticide use but requires management to prevent pest resistance.

Q3. c) Write a note on typhoid fever.

Solution:

Step 1: Introduction to Typhoid Fever.

Typhoid fever is a bacterial infection caused by *Salmonella enterica* serotype Typhi. It is transmitted through contaminated food or water and affects the intestines and bloodstream.

Step 2: Symptoms.

Common symptoms of typhoid fever include high fever, abdominal pain, weakness, headache, and loss of appetite. In severe cases, the infection can lead to complications such as intestinal perforation or septicemia.

Step 3: Diagnosis and Treatment.

1. **Diagnosis**: Typhoid fever is diagnosed through blood, stool, or urine cultures. 2. **Treatment**: The infection is treated with antibiotics such as ciprofloxacin or ceftriaxone. In some cases, vaccine prevention is recommended for individuals traveling to endemic areas.

Step 4: Conclusion.

Typhoid fever is a serious but treatable disease, and prevention includes sanitation and vaccination.

Final Answer:

Typhoid fever is a bacterial infection caused by *Salmonella Typhi*, treated with antibiotics and preven

Quick Tip

Improved sanitation and vaccination can effectively reduce the incidence of typhoid fever.

Q3. d) Explain the difference between population and community.

Solution:

Step 1: Definition of Population.

A population refers to a group of individuals of the same species living in a specific geographic area at a given time. Populations are characterized by factors such as size, density, birth rate, and mortality rate.

Step 2: Definition of Community.

A community refers to a group of different species living in a specific area and interacting with one another. It includes all the organisms that coexist within a given habitat, such as plants, animals, and microorganisms.

Step 3: Differences Between Population and Community.

1. **Population**: Consists of individuals of a single species. 2. **Community**: Includes multiple species interacting within the same area.

Step 4: Conclusion.

Thus, a population is a group of the same species, while a community consists of different species interacting in an area.

Final Answer:

A population consists of individuals of the same species, while a community includes multiple interacti

Quick Tip

Populations and communities are fundamental units in ecology, helping us understand species interactions and biodiversity.

Q3. e) Explain the importance of humans in the ecosystem.

Solution:

Step 1: Human Impact on Ecosystems.

Humans play a significant role in ecosystems, both positively and negatively. Our activities influence the environment through agriculture, industry, urbanization, and conservation efforts.

Step 2: Positive Contributions.

1. **Conservation Efforts**: Humans contribute to ecosystem health through the establishment of national parks, wildlife reserves, and sustainable agriculture practices. 2. **Restoration Projects**: Human efforts to restore ecosystems, such as reforestation and wetland restoration, help mitigate environmental degradation.

Step 3: Negative Impacts.

1. **Pollution**: Industrial and agricultural activities release pollutants into the air, water, and soil, affecting ecosystems. 2. **Deforestation and Habitat Destruction**: Human activities such as logging and urbanization lead to habitat loss and decreased biodiversity.

Step 4: Conclusion.

Humans have a profound impact on ecosystems, and it is our responsibility to engage in activities that protect and restore the environment for future generations.

Final Answer:

Humans impact ecosystems through both conservation efforts and harmful activities, making ecosystem

Quick Tip

Humans can either harm or help ecosystems, depending on whether we engage in destructive or sustainable practices.

Q4. a) What is Apomixis? Explain with example.

Solution:

Step 1: Definition of Apomixis.

Apomixis is a form of asexual reproduction in plants where seeds are produced without fertilization. The offspring is genetically identical to the parent. This process occurs when the ovule develops into a seed without the fusion of male and female gametes.

Step 2: Example of Apomixis.

A common example of apomixis is observed in certain species of *Citrus* (like lemon) and *Dandelion*. These plants produce seeds through mitotic division, ensuring that the offspring are clones of the parent.

Step 3: Conclusion.

Thus, apomixis allows plants to reproduce asexually and maintain genetic stability across generations.

Final Answer:

Apomixis is asexual reproduction in plants, where seeds are formed without fertilization.

Quick Tip

Apomixis is particularly important in agriculture for producing uniform crops.

Q4. b) What are nucleosides? Explain.

Solution:

Step 1: Definition of Nucleosides.

Nucleosides are organic molecules consisting of a nitrogenous base (purine or pyrimidine) attached to a sugar molecule (either ribose in RNA or deoxyribose in DNA).

Step 2: Structure of Nucleosides.

A nucleoside is formed when a base is linked to the sugar molecule through a glycosidic bond. In RNA, the sugar is ribose, while in DNA, it is deoxyribose.

Step 3: Examples of Nucleosides.

Examples of nucleosides include: 1. **Adenosine** (formed from adenine and ribose) 2. **Guanosine** (formed from guanine and ribose) 3. **Thymidine** (formed from thymine and deoxyribose)

Step 4: Conclusion.

Nucleosides play a key role in the structure of nucleotides, which are the building blocks of DNA and RNA.

Final Answer:

Nucleosides are composed of a nitrogenous base and a sugar molecule.

Quick Tip

Nucleosides form the basic building blocks of nucleotides, which are essential for genetic material synthesis.

Q4. c) Write a note on genetic engineering.

Solution:

Step 1: Definition of Genetic Engineering.

Genetic engineering is the direct manipulation of an organism's DNA to alter its genetic material. This is done by adding, deleting, or modifying specific genes to achieve desired traits.

Step 2: Techniques Used in Genetic Engineering.

1. **Recombinant DNA Technology**: Involves combining genes from different organisms into a single DNA molecule to produce new genetic combinations. 2. **CRISPR-Cas9**: A newer technique that allows for precise editing of genes at specific locations in the genome. 3. **Gene Cloning**: The process of making multiple copies of a gene by inserting it into a vector, usually a plasmid.

Step 3: Applications of Genetic Engineering.

1. **Agriculture**: Producing genetically modified crops with resistance to pests or diseases. 2. **Medicine**: Producing insulin, vaccines, and gene therapy. 3. **Industry**: Using microorganisms to produce chemicals, enzymes, and biofuels.

Step 4: Conclusion.

Genetic engineering has revolutionized fields such as medicine, agriculture, and industry, with both positive and controversial implications.

Final Answer:

Genetic engineering involves the manipulation of DNA to modify an organism's traits.

Quick Tip

Genetic engineering has applications in diverse fields, including agriculture, medicine, and industry.

Q4. d) What is opioid drug? Explain.

Solution:

Step 1: Definition of Opioid Drugs.

Opioid drugs are a class of substances that include both natural and synthetic compounds. They act on opioid receptors in the brain to produce pain relief and a sense of euphoria.

Step 2: Types of Opioid Drugs.

1. **Natural Opioids**: Derived from the opium poppy plant, including morphine and codeine. 2. **Semi-synthetic Opioids**: Modified versions of natural opioids, such as

heroin and oxycodone. 3. **Synthetic Opioids**: Fully synthesized in the lab, such as fentanyl and methadone.

Step 3: Effects of Opioids.

Opioids are primarily used for pain management but are highly addictive. They can cause respiratory depression, drowsiness, and, in severe cases, overdose.

Step 4: Conclusion.

Opioids are potent pain relievers but carry a high risk of addiction and overdose, making their use a major public health concern.

Final Answer:

Opioids are drugs derived from opium that provide pain relief but carry a risk of addiction.

Quick Tip

While opioids are effective for pain relief, they must be used cautiously due to their addictive potential.

Q5. a) Describe the structure of human sperm with diagram.

Solution:

Step 1: Structure of Human Sperm.

The human sperm consists of three main parts: 1. **Head**: The head contains the nucleus, which carries the genetic material (DNA). It is covered by a cap-like structure called the **acrosome**, which contains enzymes to penetrate the egg during fertilization. 2. **Midpiece**: The midpiece contains mitochondria, which provide energy for the sperm's movement. 3. **Tail (Flagellum)**: The tail is used for movement. It moves in a whip-like manner to propel the sperm toward the egg.

Step 2: Diagram of Sperm.

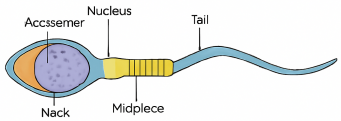


DIAGRAM OF SPERM

Step 3: Conclusion.

The structure of the sperm is highly specialized for its role in fertilization, with energy production in the midpiece and motility provided by the tail.

Final Answer:

Human sperm consists of a head, midpiece, and tail, specialized for fertilization.

Quick Tip

The acrosome in the sperm head helps in penetrating the egg during fertilization.

Q5. b) Explain the law of incomplete dominance with an example.

Solution:

Step 1: Definition of Incomplete Dominance.

Incomplete dominance occurs when neither allele in a pair is completely dominant over the other. As a result, the heterozygote exhibits a phenotype that is intermediate between the two homozygous conditions.

Step 2: Example of Incomplete Dominance.

An example of incomplete dominance is the flower color in snapdragons (*Antirrhinum majus*). In this case, when a red-flowered plant (RR) is crossed with a white-flowered plant (WW), the F1 offspring have pink flowers (RW), which is an intermediate phenotype.

Step 3: Conclusion.

Thus, incomplete dominance results in blending of traits, such as the pink color in snapdragons from red and white parents.

Final Answer:

Incomplete dominance is a form of inheritance where the heterozygote shows an intermediate phenotyp

Quick Tip

Incomplete dominance leads to a blending of traits, unlike complete dominance where one trait fully masks the other.

Q5. c) What are antibiotics? What is their importance in human life?

Solution:

Step 1: Definition of Antibiotics.

Antibiotics are chemical substances that are used to kill or inhibit the growth of bacteria and other microorganisms. They are produced by fungi, bacteria, and synthetically in laboratories.

Step 2: Importance of Antibiotics.

1. **Treatment of Infections**: Antibiotics are vital in treating bacterial infections, such as pneumonia, tuberculosis, and urinary tract infections. 2. **Prevention of Disease Spread**: Antibiotics prevent the spread of infections, saving millions of lives each year. 3. **Surgical Use**: Antibiotics are used to prevent infections in surgical procedures and help manage post-surgical wounds.

Step 3: Conclusion.

Antibiotics play a crucial role in modern medicine, saving lives by treating bacterial infections and preventing their spread.

Final Answer:

Antibiotics are crucial in treating infections, preventing disease spread, and aiding in surgery.

Quick Tip

Overuse and misuse of antibiotics can lead to antibiotic resistance, making infections harder to treat.

Q5. d) What is the use of biotechnology in the field of medicine?

Solution:

Step 1: Definition of Biotechnology in Medicine.

Biotechnology in medicine involves using biological organisms, cells, and molecular biology techniques to develop products and processes for medical applications.

Step 2: Applications of Biotechnology in Medicine.

1. **Gene Therapy**: Involves altering or replacing defective genes to treat genetic disorders. 2. **Vaccine Production**: Biotechnology is used to create vaccines against diseases like hepatitis, polio, and influenza. 3. **Production of Recombinant Proteins**: Insulin, growth hormones, and clotting factors are produced using recombinant DNA technology. 4. **Diagnostic Tools**: Biotechnology has led to the development of advanced diagnostic tools like PCR (polymerase chain reaction) for detecting infectious diseases.

Step 3: Conclusion.

Biotechnology has revolutionized medicine by providing innovative solutions for the treatment, diagnosis, and prevention of diseases.

Final Answer:

Biotechnology in medicine is used for gene therapy, vaccine production, and diagnostic tools.

Quick Tip

Biotechnology in medicine is continuously advancing, offering new treatments and diagnostic methods for various diseases.

Q6. a) Explain the difference between chemical fertilizer and biofertilizer.

Solution:

Step 1: Chemical Fertilizer.

Chemical fertilizers are man-made substances that are applied to plants to supply essential nutrients like nitrogen, phosphorus, and potassium. They are usually synthetic and provide

quick-release nutrients to plants. However, excessive use can harm the soil, cause pollution, and disrupt the ecosystem.

Step 2: Biofertilizer.

Biofertilizers are natural fertilizers that contain living microorganisms. These microorganisms help enhance the nutrient supply to plants by improving soil fertility and increasing the availability of nutrients. Examples of biofertilizers include Rhizobium (which helps fix nitrogen) and Azotobacter.

Step 3: Differences Between Chemical Fertilizer and Biofertilizer.

1. **Source**: Chemical fertilizers are synthetic, while biofertilizers are natural. 2. **Impact on Soil**: Chemical fertilizers can degrade soil quality, while biofertilizers improve soil health. 3. **Nutrient Release**: Chemical fertilizers provide immediate nutrient release, whereas biofertilizers work gradually by enhancing microbial activity in the soil.

Step 4: Conclusion.

Thus, while chemical fertilizers offer quick results, biofertilizers are more sustainable and environmentally friendly.

Final Answer:

Chemical fertilizers are synthetic, while biofertilizers are natural and improve soil health.

Quick Tip

Over-reliance on chemical fertilizers can degrade soil health, whereas biofertilizers help maintain long-term soil fertility.

Q6. b) What is a plasmid? Explain.

Solution:

Step 1: Definition of Plasmid.

A plasmid is a small, circular DNA molecule found in bacteria and some other organisms. Plasmids are separate from the chromosomal DNA and can replicate independently within the cell.

Step 2: Characteristics of Plasmids.

1. **Non-chromosomal DNA**: Plasmids exist outside the main chromosomal DNA in a cell. 2. **Role in Genetic Engineering**: Plasmids are often used as vectors to transfer foreign genes into a host organism in genetic engineering. 3. **Types of Plasmids**: There are different types of plasmids, such as F plasmids (fertility), R plasmids (resistance), and Col plasmids (colicin production).

Step 3: Conclusion.

Plasmids are important tools in biotechnology and molecular biology due to their ability to carry and transfer genetic material.

Final Answer:

A plasmid is a small, circular DNA molecule that exists independently of the chromosomal DNA.

Quick Tip

Plasmids are crucial for gene transfer in bacteria and play a key role in genetic engineering.

Q6. c) What is plant succession? Explain with an example.

Solution:

Step 1: Definition of Plant Succession.

Plant succession is the process by which plant communities change and develop over time in an ecosystem. It occurs in stages, with each stage creating conditions that are favorable for the next stage of growth.

Step 2: Types of Plant Succession.

1. **Primary Succession**: Occurs in areas where no soil or life previously existed, such as after a volcanic eruption or glacial retreat. Lichens and mosses are typically the first organisms to colonize. 2. **Secondary Succession**: Occurs in areas where a disturbance has happened, but soil is still present. This type of succession happens faster than primary succession.

Step 3: Example of Plant Succession.

An example of plant succession is the growth of vegetation in a forest after a fire. Initially, grasses and small plants colonize the area. Over time, larger plants, shrubs, and trees gradually establish themselves, forming a mature forest.

Step 4: Conclusion.

Plant succession is a natural process that leads to the gradual development of an ecosystem, enhancing biodiversity.

Final Answer:

Plant succession is the gradual process by which ecosystems develop and change over time.

Quick Tip

Succession in ecosystems is an ongoing process that leads to more complex and stable communities.

Q6. d) Write a note on immunity.

Solution:

Step 1: Definition of Immunity.

Immunity is the ability of an organism to resist or defend against infections or diseases. It is achieved through the body's immune system, which identifies and destroys pathogens such as bacteria, viruses, and other harmful microorganisms.

Step 2: Types of Immunity.

1. **Innate Immunity**: The first line of defense, which is nonspecific and includes barriers like skin, mucous membranes, and the immune cells (phagocytes). 2. **Adaptive Immunity**: A more specific response that develops over time, involving lymphocytes (B cells and T cells) that remember pathogens for faster responses in the future.

Step 3: Importance of Immunity.

Immunity plays a critical role in preventing infections, diseases, and cancers. Vaccines, for example, help train the immune system to recognize and fight specific pathogens.

Step 4: Conclusion.

The immune system is essential for maintaining health and protecting against harmful agents in the environment.

Final Answer:

Immunity is the ability of an organism to resist and fight off infections.

Quick Tip

A strong immune system is essential for health, and vaccines help enhance immunity against specific diseases.

Q7. a) Describe the menstrual cycle with a diagram.

Solution:

Step 1: Overview of the Menstrual Cycle.

The menstrual cycle is a monthly process in females that prepares the body for a potential pregnancy. It typically lasts for 28 days, though it can range from 21 to 35 days. The cycle is divided into four main phases: 1. **Menstrual Phase**: This is when the uterine lining sheds if fertilization has not occurred, resulting in menstruation (period). 2. **Follicular Phase**: Follicle-stimulating hormone (FSH) stimulates the growth of ovarian follicles, and the endometrium (lining of the uterus) thickens in preparation for implantation. 3. **Ovulation**: A mature egg is released from the dominant follicle in the ovary. This is triggered by a surge in luteinizing hormone (LH). 4. **Luteal Phase**: After ovulation, the ruptured follicle forms the corpus luteum, which secretes progesterone to maintain the uterine lining. If no fertilization occurs, the corpus luteum degenerates, leading to a decrease in progesterone and the beginning of menstruation.

Step 2: Diagram of Menstrual Cycle.

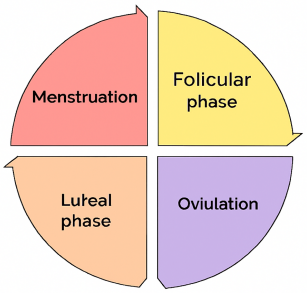


DIAGRAM OF MENSTRUAL CYCLE

Step 3: Conclusion.

The menstrual cycle is regulated by hormonal changes and involves the maturation of an egg, the shedding of the uterine lining, and preparation for potential pregnancy.

Final Answer:

The menstrual cycle involves four phases: Menstrual, Follicular, Ovulation, and Luteal.

Quick Tip

Tracking the menstrual cycle can help with understanding fertility and reproductive health.

Or

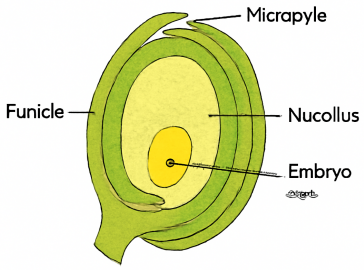
Q7. Describe the structure of a typical ovule with a diagram.

Solution:

Step 1: Structure of Ovule.

An ovule is the female gametophyte found in the ovary of seed plants. The main parts of the ovule include: 1. **Integuments**: Two layers that surround and protect the ovule, except for a small opening called the micropyle. 2. **Nucellus**: The central tissue, which contains the female gamete (egg cell). 3. **Embryo Sac**: The female gametophyte, where fertilization occurs. It contains the egg cell, two polar nuclei, and other supporting cells. 4. **Micropyle**: The opening through which pollen tube enters during fertilization.

Step 2: Diagram of Ovule.



STRUCTURE OF A TYPICAL OVULE

Step 3: Conclusion.

The ovule's structure is vital for protecting the egg and facilitating fertilization in flowering plants.

Final Answer:

A typical ovule consists of integuments, nucellus, embryo sac, and micropyle.

Quick Tip

The micropyle is an essential part of the ovule as it allows the pollen tube to reach the egg during fertilization.

Q8. a) Explain Oparin's theory related to the origin of life.

Solution:

Step 1: Introduction to Oparin's Theory.

Oparin's theory of the origin of life, also known as the *Chemical Evolution Theory*, was proposed by Alexander Oparin in 1924. According to Oparin, life originated from simple organic molecules through chemical reactions in the early Earth environment.

Step 2: Stages of Life's Origin According to Oparin.

1. **Prebiotic Chemistry**: Oparin proposed that in the primitive atmosphere, there were no free oxygen molecules, and the atmosphere consisted mainly of methane (CH), ammonia (NH), hydrogen (H), and water vapor (HO). In such an environment, simple molecules like methane and ammonia could react under the influence of energy sources (like lightning or

UV radiation) to form organic molecules. 2. **Formation of Colloidal Systems**: Oparin suggested that, over time, these organic molecules formed more complex substances, such as amino acids and proteins. These complex molecules formed colloidal systems, which were precursors to cells. 3. **Coacervates**: He proposed that these molecules aggregated into ”coacervates,” or droplets, which were the first primitive forms of life. Coacervates could maintain internal conditions separate from their environment, much like cells do today. 4. **Evolution to Protoplasm**: Over time, these coacervates could have developed the ability to replicate and metabolize, leading to the formation of simple life forms.

Step 3: Conclusion.

Oparin’s theory laid the foundation for understanding how life might have arisen from non-living matter through gradual chemical processes.

Final Answer:

Oparin’s theory suggests that life originated from simple organic molecules through chemical reactions

Quick Tip

Oparin’s theory of chemical evolution influenced later experiments, such as the Miller-Urey experiment, which simulated early Earth conditions.

Or

Q8. (A) Write a note on Colour blindness.

Solution:

Step 1: Definition of Colour Blindness.

Colour blindness, also known as color vision deficiency, is a visual impairment where individuals are unable to perceive certain colors or differences between colors. It is most commonly inherited and affects a large proportion of the male population.

Step 2: Causes of Colour Blindness.

1. **Genetic Cause**: The most common cause is a genetic mutation in the X chromosome, leading to an inability to produce the photopigments needed for color detection. 2. **Types

of Colour Blindness**: - **Red-Green Color Blindness**: The most common type, where individuals cannot distinguish between red and green hues. - **Blue-Yellow Color Blindness**: Less common, where individuals have difficulty distinguishing between blue and yellow hues. - **Total Colour Blindness**: A rare condition where individuals cannot perceive any color and see everything in shades of grey.

Step 3: Conclusion.

Colour blindness is a hereditary condition that affects the ability to perceive colors, with red-green color blindness being the most common form.

Final Answer:

Colour blindness is a condition where individuals cannot perceive certain colors, commonly due to a ge

Quick Tip

While there is no cure for color blindness, color correction lenses and apps can help individuals perceive colors more accurately.

(B) Write a note on Thalassaemia.

Solution:

Step 1: Definition of Thalassaemia.

Thalassaemia is a genetic blood disorder characterized by abnormal hemoglobin production. It results in excessive destruction of red blood cells, leading to anemia. The condition is inherited and can range from mild to severe.

Step 2: Types of Thalassaemia.

1. **Alpha Thalassaemia**: Caused by a mutation in the genes responsible for producing the alpha-globin chain of hemoglobin. This leads to a reduction in alpha-globin production.
2. **Beta Thalassaemia**: Caused by a mutation in the beta-globin gene, leading to decreased production of beta-globin chains. This is more common and often more severe than alpha thalassemia.

Step 3: Symptoms of Thalassaemia.

1. **Mild to Severe Anemia**: Individuals may experience fatigue, weakness, and pale skin. 2. **Splenomegaly**: Enlargement of the spleen due to increased red blood cell destruction. 3. **Bone Deformities**: Severe cases can lead to abnormal bone growth, particularly in the face.

Step 4: Treatment.

Treatment includes blood transfusions, iron chelation therapy (to remove excess iron from blood), and in some cases, bone marrow transplants.

Step 5: Conclusion.

Thalassaemia is a serious genetic disorder that can be managed with proper medical care, but early detection and genetic counseling are important for managing the condition.

Final Answer:

Thalassaemia is a genetic blood disorder resulting in abnormal hemoglobin production, leading to anem

Quick Tip

Genetic counseling is important for families affected by thalassaemia to understand the risk of inheritance.

Q9. a) Write an essay on search for genetic material.

Solution:

Introduction to Genetic Material.

The search for genetic material refers to the quest to identify the substance that carries genetic information in living organisms. Initially, scientists believed that proteins were the carriers of genetic information because of their complexity. However, the discovery that DNA, not protein, was the genetic material revolutionized the field of genetics.

Step 1: Early Discoveries.

1. **Gregor Mendel**: Mendel's experiments with pea plants laid the foundation for the study of inheritance, but the chemical nature of inheritance was not understood until much

later. 2. **Friedrich Miescher (1869)**: Miescher discovered a substance in the nucleus of cells, which he called “nuclein,” later known as DNA.

Step 2: The Role of DNA.

1. **Oswald Avery (1944)**: Avery and his team showed that DNA was the transforming principle in bacteria, suggesting that DNA is the material that carries genetic information. 2. **Watson and Crick (1953)**: James Watson and Francis Crick discovered the double helix structure of DNA, which was crucial in understanding how genetic information is stored and transmitted.

Step 3: Further Developments in Genetics.

1. **DNA Sequencing**: With the advent of techniques like PCR (Polymerase Chain Reaction) and DNA sequencing, scientists can now decode the entire genetic makeup of organisms. 2. **Genomic Medicine**: The understanding of genetic material has opened up new avenues for personalized medicine, where treatments can be tailored based on an individual’s genetic profile.

Step 4: Conclusion.

The search for genetic material has been pivotal in shaping modern biology and medicine. From Mendel’s laws of inheritance to the mapping of the human genome, the discovery of DNA as the genetic material has been one of the most significant scientific achievements.

Final Answer:

The discovery of DNA as the genetic material was a milestone in the field of genetics and biology.

Quick Tip

The discovery of DNA structure by Watson and Crick has paved the way for molecular biology, genetics, and genomic medicine.

OR

Q9. What do you understand by biodiversity? How can it be preserved?

Solution:

Step 1: Definition of Biodiversity.

Biodiversity refers to the variety and variability of life forms in a given ecosystem, ranging from the genetic diversity within species to the diversity of ecosystems on Earth. It includes: 1. **Genetic Diversity**: The variation in genetic material within a population or species. 2. **Species Diversity**: The variety of different species within a habitat or ecosystem. 3. **Ecosystem Diversity**: The variety of ecosystems, including forests, wetlands, and coral reefs.

Step 2: Importance of Biodiversity.

1. **Ecological Balance**: Biodiversity maintains the balance of ecosystems, which are vital for the survival of life on Earth. 2. **Medicinal Value**: Many medicines are derived from plants, animals, and microorganisms, and biodiversity ensures a continuous supply of resources for health and medicine. 3. **Cultural and Aesthetic Value**: Biodiversity contributes to cultural practices and enhances human well-being through aesthetic and recreational benefits.

Step 3: How Can Biodiversity Be Preserved?

1. **Protected Areas**: Establishing protected areas, such as national parks and wildlife reserves, helps conserve biodiversity by safeguarding ecosystems and species. 2. **Sustainable Practices**: Implementing sustainable agricultural, forestry, and fishing practices to reduce the impact on natural habitats. 3. **Restoration Projects**: Engaging in habitat restoration to revive ecosystems that have been degraded by human activities. 4. **Legislation**: Governments can pass laws to protect endangered species and regulate harmful activities that threaten biodiversity.

Step 4: Conclusion.

Biodiversity is essential for maintaining the health of our planet. It provides the resources necessary for food, medicine, and ecosystem services, making its preservation critical for future generations.

Final Answer:

Biodiversity is the variety of life on Earth, and its preservation is crucial for ecological balance, health,

Quick Tip

Preserving biodiversity is crucial not only for the environment but also for the future survival of humanity.
