UP Board 12 Biology (348 (GI)) Question Paper with Solutions

Time Allowed :3 hours	**Maximum Marks :**70	**Total questions :**33

General Instructions

Read the following instructions very carefully and strictly follow them:

1. **All questions are compulsory.**
2. **Illustrate your answers with labeled diagrams, wherever necessary.**
3. **Marks allotted to each question are mentioned against it.**

Multiple Choice Type Questions

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1. (a) Which organ in flowers represents the female reproductive organ?

(A) Gynoecium

(B) Androecium

(C) Anther

(D) Tapetum

Correct Answer: (A) Gynoecium

Solution:

The female reproductive organ in flowers is called the gynoecium. It consists of carpels, which include the stigma, style, and ovary. The ovary contains ovules, which develop into seeds after fertilization.

Quick Tip

Remember: Gynoecium = Female part (contains ovary, style, stigma); Androecium = Male part (contains anther, filament).

(b) How many testis are found in the male reproductive system?

(A) 1 (one)

(B) 1 pair (one pair)

(C) 2 pairs (two pairs)

(D) 3 pairs (three pairs)

Correct Answer: (B) 1 pair (one pair)

Solution:

The human male reproductive system contains one pair of testis (two testes), which are responsible for producing sperm and male sex hormones such as testosterone.

Quick Tip

Remember: Males have one pair (two) of testes, which produce sperm and hormones like testosterone.

1. (c) The full form of MRI is:

(A) Metaphasic Resonance Imaging

(B) Magnetic Resonance Imaging

(C) Magnetic Resonance Immunity

(D) Metaphasic Reo Imaging

Correct Answer: (B) Magnetic Resonance Imaging

Solution:

MRI (Magnetic Resonance Imaging) is a medical imaging technique used to visualize internal structures of the body using strong magnetic fields and radio waves. It is commonly used for brain, spinal cord, and joint imaging.

Quick Tip

Remember: MRI stands for Magnetic Resonance Imaging and is used to create detailed images of organs and tissues.

(d) Sickle Cell Anemia is an example of which type of mutation?

(A) Point mutation

(B) Aneuploidy

(C) Deletion

(D) Translocation

Correct Answer: (A) Point mutation

Solution:

Sickle cell anemia is caused by a point mutation in the beta-globin gene, where a single nucleotide substitution (adenine to thymine) results in the production of abnormal hemoglobin (HbS). This mutation leads to the deformation of red blood cells into a sickle shape, causing various health complications.

Quick Tip

Remember: Sickle cell anemia results from a point mutation where a single nucleotide change affects hemoglobin structure.

Very Short Answer Type Questions

2. (a) Down's syndrome occurs due to abnormality of which pair of chromosomes?

Solution:

Down's syndrome is caused by trisomy of the 21st chromosome, meaning an individual has three copies of chromosome 21 instead of the normal two. This results in developmental delays and characteristic physical features.

Quick Tip

Remember: Down's syndrome = Trisomy of chromosome 21 (three copies instead of two).

(b) Write the name of any one contraceptive used by females.

Solution:

Oral contraceptive pills contain hormones (estrogen and progesterone) that prevent ovulation and thus pregnancy. Other common contraceptives include intrauterine devices (IUDs) and barrier methods.

Quick Tip

Remember: Common female contraceptives include pills (hormonal) and IUDs (mechanical devices).

(c) Which sugar is present in RNA?

Solution:

RNA (Ribonucleic Acid) contains ribose sugar, which is a five-carbon sugar with one hydroxyl group (-OH) at the 2' position, making it different from deoxyribose in DNA.

Quick Tip

Remember: RNA contains ribose sugar, while DNA contains deoxyribose (without one oxygen atom).

(d) The development of male gametophyte occurs in which organ of the flower?

Solution:

The male gametophyte (pollen grain) develops inside the anther of a flower, where microspore mother cells undergo meiosis to form haploid microspores that develop into pollen grains.

Quick Tip

Remember: Male gametophyte (pollen grains) develop inside the anther of the stamen.

(e) Sperms are formed after which type of division in male germ cells?

Solution:

In the male reproductive system, sperms are formed through meiosis in the seminiferous tubules of the testes. This process is called spermatogenesis and results in haploid sperm cells.

Quick Tip

Remember: Sperms are formed through meiosis, producing haploid cells for fertilization.

Short Answer Type Questions I

3. (a) Write down two functions of the pituitary gland.

Solution:

Two important functions of the pituitary gland are:

1. It regulates growth and development by secreting growth hormone (GH).
2. It controls various endocrine glands such as the thyroid, adrenal glands, and gonads by releasing stimulating hormones.

Quick Tip

Remember: The pituitary gland is known as the ”master gland” because it controls other endocrine glands and regulates growth.

(b) Define Xenogamy.

Solution:

Xenogamy is the transfer of pollen grains from the anther of one flower to the stigma of another flower of a different plant of the same species. Xenogamy ensures cross-pollination, leading to genetic variation and improved adaptability in plants.

Quick Tip

Remember: Xenogamy = Cross-pollination between different plants of the same species.

(c) What are parthenocarpic fruits? Give one example.

Solution:

Parthenocarpic fruits are seedless fruits that develop without fertilization.

Example: Banana. Parthenocarpy occurs naturally or can be induced artificially through hormone application, producing seedless fruits like bananas and pineapples.

Quick Tip

Remember: Parthenocarpy = Seedless fruit development without fertilization; e.g., banana.

(d) Describe any two functions of a promoter.

Solution:

Two key functions of a promoter are:

1. It provides a binding site for RNA polymerase to initiate transcription.
2. It regulates the timing and rate of gene expression in response to cellular signals.

Quick Tip

Remember: Promoters initiate transcription and regulate gene expression levels.

(e) Write down the names of any two sex-linked diseases in humans.

Solution:

Solution:

Two common sex-linked diseases in humans are:

1. Hemophilia
2. Color blindness

Sex-linked diseases are caused by mutations in genes located on sex chromosomes (X or Y). Since males have only one X chromosome, they are more frequently affected by X-linked disorders.

Quick Tip

Remember: Hemophilia and color blindness are common X-linked disorders affecting males more than females.

Short Answer Type Questions II

4. (a) Mention the causes of cancer in humans.

Solution:

The main causes of cancer in humans include:

1. **Genetic factors:** Mutations in oncogenes and tumor suppressor genes.
2. **Carcinogens:** Exposure to tobacco smoke, radiation, and chemicals.
3. **Viral infections:** Certain viruses like HPV and Hepatitis B can trigger cancer.

Quick Tip

Remember: Cancer causes include genetic mutations, exposure to carcinogens, and viral infections.

(b) Explain Allergy with examples.

Solution:

Allergy is an exaggerated immune response to normally harmless substances such as pollen, dust, or certain foods.

Examples:

- Allergic rhinitis (hay fever) due to pollen.
- Skin allergies due to contact with irritants like latex.

Quick Tip

Remember: Allergy is an overreaction of the immune system to allergens like pollen, dust, and certain foods.

(c) Write the full form of BOD and comment on it.

Solution:

BOD : Biological Oxygen Demand

BOD is a vital tool for assessing the organic pollution load in water bodies and ensuring the sustainability of aquatic ecosystems. By monitoring BOD levels, scientists and policymakers can identify pollution sources, implement effective wastewater treatment strategies, and protect aquatic life. However, its limitations necessitate the use of complementary tests for a more holistic understanding of water quality.

Quick Tip

Remember: High BOD means high organic pollution in water, leading to reduced oxygen availability for aquatic life.

(d) Comment on productivity.

Solution:

Productivity in an ecosystem refers to the rate of biomass production by producers through photosynthesis It includes:

- **Gross Primary Productivity (GPP):** Total energy produced.
- **Net Primary Productivity (NPP):** Energy available after respiratory losses.

Quick Tip

Remember: Productivity measures energy flow in an ecosystem; NPP = GPP - energy used in respiration.

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6. (a) Describe the Chromosome theory of Genetics.

Solution:

The Chromosome Theory of Genetics provides a comprehensive explanation for how genetic information is stored, transmitted, and expressed. By linking Mendel's laws of inheritance to the physical behavior of chromosomes, it established the foundation for modern genetics and continues to guide research in biology, medicine, and biotechnology. This theory underscores the intricate relationship between cellular structures and the inheritance of traits across generations.

Quick Tip

Remember: Chromosome theory links genes to chromosomes, explaining inheritance based on Mendel's laws.

(b) Describe the importance of Biotechnology in human welfare.

Solution:

Biotechnology is a powerful tool for enhancing human welfare by addressing critical issues in health, agriculture, industry, and the environment. Its applications not only improve the quality of life but also promote sustainable development, ensuring a better future for humanity. As advancements in biotechnology continue, its potential to solve global challenges and improve human well-being will only grow stronger. However, ethical considerations and responsible use of biotechnology remain essential to ensure its benefits are shared equitably and safely.

Quick Tip

Remember: Biotechnology benefits human welfare through medical advancements and improved agriculture.

(c) How does co-extinction damage biodiversity? Describe with example.

Solution:

Co-extinction refers to the phenomenon where the extinction of one species leads to the extinction of another species that is dependent on it. This process highlights the intricate interdependence among organisms within ecosystems and demonstrates how biodiversity loss can cascade through ecological networks. Co-extinction damages biodiversity by disrupting these relationships, leading to a decline in ecosystem stability, functionality, and resilience.

Examples of Co-Extinction

1. Pollinators and Plants

Scenario : Many plants rely on specific pollinators (e.g., bees, butterflies, or birds) for reproduction. If a pollinator species goes extinct due to habitat loss, pesticide use, or climate change, the plants that depend on it may also face extinction.

Example : The extinction of certain bee species could lead to the co-extinction of plant species that rely exclusively on those bees for pollination. For instance, the relationship between the Yucca plant and the Yucca moth is highly specialized. If the Yucca moth were to go extinct, the Yucca plant would lose its only pollinator and could also become extinct.

Quick Tip

Remember: Co-extinction happens when dependent species are lost, like plant species relying on specific pollinators.

(d) Highlight the importance of fungi in the production of antibiotics, with examples.

Solution:

Fungi are indispensable in the production of antibiotics, providing humanity with some of the most effective tools to combat bacterial infections. From penicillin to cephalosporins, fungi-derived antibiotics have saved countless lives and remain a cornerstone of modern medicine. As antibiotic resistance becomes a growing global concern, fungi continue to offer hope for discovering new treatments. Their natural ability to produce diverse antimicrobial compounds underscores their critical role in human health and welfare.

Quick Tip

Remember: Fungi produce antibiotics like penicillin (from *Penicillium*) to fight bacterial infections.

Long Answer Type Questions I

7. Describe the energy flow in an ecosystem with diagrams.

Solution:

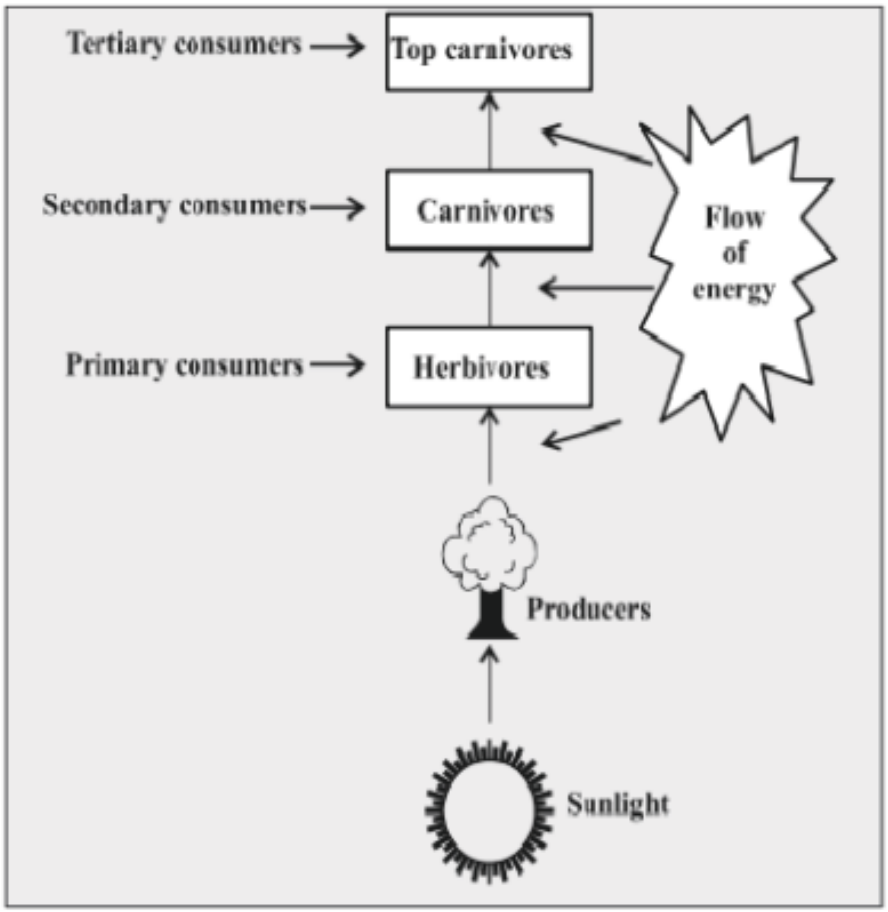
Energy flow in an ecosystem follows the unidirectional transfer of energy from the sun to producers and then to consumers.

Key steps in energy flow:

1. **Producers:** Capture solar energy through photosynthesis (e.g., plants, algae).
2. **Primary Consumers:** Herbivores that consume producers (e.g., deer, rabbits).
3. **Secondary Consumers:** Carnivores that feed on herbivores (e.g., foxes, birds).

4. **Tertiary Consumers:** Top predators that feed on secondary consumers (e.g., lions, eagles).

Diagram:



Flow chart of energy in ecosystem

Quick Tip

Remember: Energy flows in a one-way direction, with producers converting solar energy into food, followed by consumers and decomposers.

OR Describe the different components of an ecosystem.

Solution:

An ecosystem is a complex and dynamic system where biotic and abiotic components interact to sustain life. Producers, consumers, and decomposers form the biological backbone of the ecosystem, while physical and chemical factors provide the necessary environment for life to thrive. Understanding these components and their interactions is

crucial for conserving ecosystems and ensuring their sustainability in the face of environmental challenges like climate change, pollution, and habitat destruction.

An ecosystem consists of two main components:

1. Biotic Components (Living):

- **Producers:** Autotrophs like plants that produce food through photosynthesis.
- **Consumers:** Herbivores, carnivores, omnivores that obtain energy from other organisms.
- **Decomposers:** Microorganisms like bacteria and fungi that break down organic matter.

2. Abiotic Components (Non-living):

- Sunlight, temperature, water, air, and soil that influence ecosystem functioning.

Quick Tip

Remember: Ecosystems consist of living (biotic) and non-living (abiotic) components interacting with each other.

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8. What do you understand by chromosomal aberrations? Describe any two aberrations.

Solution:

Chromosomal aberrations are significant disruptions in the structure or number of chromosomes, leading to a wide range of effects on an organism's health and development. Understanding these aberrations helps in diagnosing genetic disorders, studying evolutionary processes, and advancing medical research. While some aberrations are harmless or beneficial (e.g., polyploidy in plants), many result in severe consequences, emphasizing the importance of maintaining chromosomal integrity.

Chromosomal aberrations are structural or numerical changes in chromosomes that lead to genetic disorders.

Types of chromosomal aberrations:

1. **Deletion:** Loss of a chromosome segment, e.g., Cri-du-chat syndrome.
2. **Duplication:** A chromosome segment is repeated, leading to genetic disorders.

Quick Tip

Remember: Chromosomal aberrations involve changes in number (trisomy, monosomy) or structure (deletion, duplication).

OR Describe the Hardy-Weinberg principle.

Solution:

The Hardy-Weinberg principle states that allele and genotype frequencies in a population remain constant if no evolutionary influences are acting upon it.

Key conditions:

- Large population size.
- No mutation, migration, or natural selection.
- Random mating within the population.

Equation:

$$p^2 + 2pq + q^2 = 1$$

where:

- p^2 = frequency of homozygous dominant genotype,
- $2pq$ = frequency of heterozygous genotype,
- q^2 = frequency of homozygous recessive genotype.

Quick Tip

Remember: The Hardy-Weinberg principle predicts genetic equilibrium, assuming no evolutionary forces act on a population.

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9. DNA is a genetic material - Prove it with the description of an experiment.

Solution:

The experiment that proved DNA as the genetic material was conducted by Avery, MacLeod, and McCarty, followed by confirmation through the Hershey-Chase experiment.

Hershey and Chase Experiment (1952):

1. They used bacteriophages (viruses that infect bacteria) labeled with radioactive isotopes.
2. DNA was labeled with radioactive phosphorus (^{32}P), and proteins were labeled with radioactive sulfur (^{35}S).
3. The bacteriophages were allowed to infect bacterial cells, and the infected cells were analyzed.
4. Radioactive phosphorus (^{32}P) was found inside the bacterial cells, whereas radioactive sulfur (^{35}S) remained outside.

Conclusion:

Since only DNA entered the bacterial cells and directed viral replication, it was concluded that DNA is the genetic material.

Quick Tip

Remember: Hershey-Chase experiment used radioactive labeling of DNA (^{32}P) and protein (^{35}S) to prove DNA is the genetic material.

OR Describe the following in brief:

(a) DNA Polymorphism

Solution:

DNA polymorphism refers to variations in DNA sequences among individuals of the same species. These variations are commonly found in non-coding regions of the DNA and serve as genetic markers.

Types of DNA Polymorphism:

- **Single Nucleotide Polymorphism (SNP):** A single base-pair change in the DNA sequence.
- **Short Tandem Repeats (STR):** Repeated sequences of short DNA segments.

Applications:

- DNA fingerprinting for forensic identification.

- Evolutionary studies and genetic disease research.

Quick Tip

Remember: DNA polymorphism = genetic variation; used in DNA fingerprinting and genetic studies.

(b) Bioinformatics

Solution:

Bioinformatics is an interdisciplinary field that combines biology, computer science, and information technology to analyze and interpret biological data such as DNA and protein sequences.

Applications of Bioinformatics:

- Genome sequencing and annotation.
- Drug discovery and personalized medicine.
- Evolutionary studies and protein structure prediction.

Quick Tip

Remember: Bioinformatics helps analyze DNA/protein data using computational tools for genome sequencing and drug discovery.
