UP Board 12 Biology (348(GH)) 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) The endosperm of an angiospermic plant is:

(A) Haploid

(B) Diploid

(C) Triploid

(D) Polyploid

Correct Solution: (C) Triploid

Solution:

In angiosperms, the endosperm is formed through double fertilization. One sperm nucleus fertilizes the egg to form the zygote (diploid), while the other fuses with the two polar nuclei, forming a triploid (3n) endosperm, which nourishes the embryo.

Quick Tip

Remember: The endosperm of flowering plants is triploid (3n), formed by the fusion of one male gamete with two polar nuclei.

(b) The Widal test is used for the diagnosis of which disease?

(A) Cholera

(B) Malaria

(C) Pneumonia

(D) Typhoid

Correct Solution: (D) Typhoid

Solution:

The Widal test detects antibodies in the blood against the bacteria *Salmonella typhi*, which causes typhoid fever. A significant rise in antibody levels confirms the infection.

Quick Tip

Remember: Widal test detects typhoid, caused by *Salmonella typhi*; it measures specific antibodies in the blood.

(c) How many meiotic divisions are required to produce 108 microspores from microspore mother cells?

(A) 54

(B) 27

(C) 107

(D) 216

Correct Solution: (B) 27

Solution:

Each microspore mother cell undergoes meiosis to produce four haploid microspores. To produce 108 microspores, the number of meiotic divisions required is $108 \div 4 = 27$.

Quick Tip

Remember: Each meiosis in a microspore mother cell produces 4 microspores, so divide the total required by 4 to find the number of divisions.

(d) 'Down's Syndrome' is caused due to:

(A) Monosomy of sex chromosomes

(B) Trisomy of sex chromosomes

(C) Trisomy of 21st pair of chromosomes

(D) Monosomy of 21st pair of chromosomes

Correct Solution: (C) Trisomy of 21st pair of chromosomes

Solution:

Down's Syndrome is a genetic disorder caused by the presence of an extra copy of chromosome 21, resulting in a total of 47 chromosomes instead of the normal 46.

Quick Tip

Remember: Down's Syndrome results from an extra 21st chromosome (Trisomy 21), leading to developmental and physical changes.

Very Short Answer Type Questions

2. (a) Write any two causes of biodiversity loss.

Solution:

Two major causes of biodiversity loss are:

1. **Habitat destruction:** Deforestation and urbanization lead to loss of natural habitats.
2. **Pollution:** Air, water, and soil pollution adversely affect ecosystems and species survival.

Quick Tip

Remember: The main causes of biodiversity loss include habitat destruction and pollution, which disturb ecological balance.

(b) Name any one sex-linked recessive disorder in human beings.

Solution:

Hemophilia is a genetic disorder where blood does not clot properly due to a deficiency of clotting factors. It is caused by a recessive gene located on the X chromosome.

Quick Tip

Remember: Hemophilia and color blindness are common X-linked recessive disorders, affecting males more frequently.

(c) Write the full form of IUD.

Solution:

An IUD is a contraceptive device inserted into the uterus to prevent pregnancy by inhibiting sperm movement and egg fertilization.

Quick Tip

Remember: IUD stands for Intrauterine Device, used for long-term contraception.

(d) Write the names of any two blue-green algae (Cyanobacteria) responsible for nitrogen fixation.

Solution:

Cyanobacteria such as *Anabaena* and *Nostoc* are known for their ability to fix atmospheric nitrogen into usable forms for plants, enhancing soil fertility.

Quick Tip

Remember: Cyanobacteria like *Anabaena* and *Nostoc* help convert atmospheric nitrogen into plant-usable forms.

(e) What is Gel Electrophoresis?

Solution:

In gel electrophoresis, negatively charged DNA fragments move towards the positive electrode through an agarose gel, with smaller fragments moving faster than larger ones, allowing separation based on size.

Quick Tip

Remember: Gel electrophoresis separates DNA based on size using an electric field, smaller fragments move faster.

Short Answer Type Questions I

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3. (a) What do you mean by Medical Termination of Pregnancy (MTP)?

Solution:

Medical Termination of Pregnancy (MTP) refers to the intentional termination of pregnancy using medical or surgical methods before the fetus can sustain independent life.MTP is performed to prevent unwanted pregnancies, in cases of fetal abnormalities, or when the pregnancy endangers the mother's health. It is regulated by legal and medical guidelines to ensure safety.

Quick Tip

Remember: MTP is legally allowed under medical supervision to ensure the health of the mother and prevent unsafe abortions.

(b) What is Human Insulin?

Solution:

Human insulin is a hormone produced by the pancreas that regulates blood glucose levels by facilitating glucose uptake into cells. Human insulin can also be produced using recombinant DNA technology, where the insulin gene is inserted into bacterial cells to produce insulin artificially for diabetic patients.

Quick Tip

Remember: Human insulin helps regulate blood sugar and can be synthesized using recombinant DNA technology.

(c) What is active and passive immunity?

Solution:

Active immunity: Immunity developed by the body after exposure to a pathogen or vaccination.

Passive immunity: Immunity acquired through the transfer of antibodies from another source, such as mother's milk or antibody injections. Active immunity provides long-term protection by stimulating the immune system, whereas passive immunity provides immediate but temporary protection without activating the immune system.

Quick Tip

Remember: Active immunity lasts longer and requires antigen exposure; passive immunity is immediate but short-lived.

(d) Write any two differences between DNA and RNA.

Solution:

DNA	RNA
Double-stranded structure	Single-stranded structure
Contains thymine (T)	Contains uracil (U) instead of thymine

DNA is a stable molecule that stores genetic information, whereas RNA is involved in protein synthesis and other cellular functions.

Quick Tip

Remember: DNA is double-stranded and stable; RNA is single-stranded and plays roles in protein synthesis.

(e) Define productivity in an ecosystem.

Solution:

Productivity in an ecosystem refers to the rate at which biomass or organic matter is produced by producers through photosynthesis. Ecosystem productivity is categorized into gross primary productivity (GPP), which is the total rate of photosynthesis, and net primary productivity (NPP), which is the energy remaining after respiratory losses.

Quick Tip

Remember: Productivity measures energy production in an ecosystem; GPP includes total energy, and NPP is available for consumers.

Short Answer Type Questions II

4. (a) Describe mutation with an example.

Solution:

Mutation is a sudden heritable change in the DNA sequence of an organism, which can lead to variations.

Example: Sickle cell anemia is caused by a point mutation in the hemoglobin gene, where adenine (A) is replaced by thymine (T), resulting in the production of abnormal hemoglobin.

Quick Tip

Remember: Mutations can be spontaneous or induced; examples include sickle cell anemia and albinism.

(b) What is genetic engineering? Write any two applications of genetic engineering.

Solution:

Genetic engineering is the direct manipulation of an organism's genes using biotechnology to introduce desirable traits.

Applications:

- Production of genetically modified crops with higher yield and resistance.
- Synthesis of insulin using recombinant DNA technology for diabetes treatment.

Quick Tip

Remember: Genetic engineering is used for creating GMOs and producing medicines like insulin.

(c) Write a note on Nucleotide.

Solution:

A nucleotide is the basic structural unit of nucleic acids (DNA and RNA), consisting of three components: a nitrogenous base, a sugar (deoxyribose or ribose), and a phosphate group.

Quick Tip

Remember: Nucleotides = Nitrogenous base + Sugar + Phosphate; they form the building blocks of DNA and RNA.

(d) Describe the symptoms of Pneumonia and Amoebiasis.

Solution:

Pneumonia Symptoms:

- Difficulty in breathing and chest pain.
- Fever, chills, and persistent cough with mucus.

Amoebiasis Symptoms:

- Abdominal pain and diarrhea.
- Presence of blood and mucus in stools.

Quick Tip

Remember: Pneumonia affects lungs (breathing issues), while Amoebiasis affects intestines (diarrhea with blood).

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5. (a) Describe the medicinal use of microorganisms.

Solution:

Microorganisms are widely used in medicine to produce antibiotics, vaccines, and enzymes.

Examples:

- *Penicillium* produces the antibiotic penicillin.
- Bacteria like *Lactobacillus* are used in probiotic treatments.

Quick Tip

Remember: Microbes are used to make antibiotics (e.g., Penicillin) and vaccines (e.g., BCG).

(b) Write a note on allergy.

Solution:

An allergy is an overreaction of the immune system to harmless substances such as pollen, dust, or certain foods, leading to symptoms like sneezing, rashes, and difficulty in breathing.

Quick Tip

Remember: Allergies occur due to an exaggerated immune response; common allergens include pollen, dust, and foods.

(c) Write a short note on over-exploitation and co-extinction.

Solution:

Over-exploitation: Over-exploitation refers to the excessive use or harvesting of natural resources, such as plants, animals, minerals, or water, at a rate faster than they can be naturally replenished. This unsustainable practice often arises due to human activities like overfishing, deforestation, hunting, and illegal wildlife trade. Over-exploitation disrupts ecosystems, depletes biodiversity, and threatens the survival of many species. For example, overfishing has led to the collapse of several fish populations, while excessive logging has resulted in the loss of forest habitats. The consequences of over-exploitation extend beyond individual species, affecting entire ecosystems and the services they provide, such as clean air, water, and soil fertility.

Co-extinction: Co-extinction occurs when the extinction of one species leads to the extinction of another species that is dependent on it. This phenomenon highlights the intricate interdependence among organisms within ecosystems. For instance, if a plant species goes extinct, the pollinators (such as bees or butterflies) that rely exclusively on that plant for food may also face extinction. Similarly, the extinction of a host species can lead to the disappearance of parasites or symbiotic organisms associated with it. Co-extinction underscores the cascading effects of biodiversity loss and emphasizes the importance of conserving not just individual species but entire ecological networks..

Quick Tip

Remember: Over-exploitation reduces resources; co-extinction happens when dependent species go extinct.

(d) Write a short note on any three chromosomal aberrations (syndromes) found in

humans.

Solution:

1. Down's Syndrome: Trisomy of chromosome 21, causing mental retardation and characteristic facial features.

2. Klinefelter's Syndrome: Males with an extra X chromosome (XXY), leading to reduced fertility and feminine characteristics.

3. Turner's Syndrome: Females with a single X chromosome (XO), leading to short stature and lack of sexual development.

Quick Tip

Remember: Down's (21 trisomy), Klinefelter's (XXY), Turner's (XO); each affects growth and development.

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6. (a) Write a note on Natural Selection.

Solution:

Natural Selection is a fundamental mechanism of evolution, first articulated by Charles Darwin in the 19th century. It explains how species evolve over time through the differential survival and reproduction of individuals with advantageous traits. The process of natural selection is often summarized as "survival of the fittest," where "fitness" refers to an organism's ability to survive and reproduce in a given environment.

Quick Tip

Remember: Natural selection favors traits that enhance survival and reproduction, leading to evolutionary adaptation.

(b) Differentiate between Phenotype and Genotype.

Solution:

Phenotype	Genotype
Observable physical traits	Genetic makeup of an organism
Affected by environmental factors	Determined by inherited genes
Example: Tall or short plant	Example: TT, Tt, or tt

Phenotype refers to the visible characteristics of an organism, while genotype represents the genetic code that determines those traits.

Quick Tip

Remember: Phenotype = appearance; genotype = genetic composition. Phenotype can be influenced by the environment.

(c) Write a note on seven contrasting traits studied by Mendel in pea plants.

Solution:

Gregor Mendel studied seven contrasting traits in pea plants:

1. Plant height: Tall (T) vs Dwarf (t)
2. Flower position: Axial (A) vs Terminal (a)
3. Pod shape: Inflated (I) vs Constricted (i)
4. Pod color: Green (G) vs Yellow (g)
5. Seed shape: Round (R) vs Wrinkled (r)
6. Seed color: Yellow (Y) vs Green (y)
7. Flower color: Purple (P) vs White (p)

Mendel selected these traits because they exhibited clear dominant and recessive characteristics and followed predictable inheritance patterns.

Quick Tip

Remember: Mendel's seven traits include height, flower position, pod shape/color, seed shape/color, and flower color.

(d) Write short notes on the following: (i) Bioinformatics

Solution:

Bioinformatics is an interdisciplinary field that uses computational tools to analyze and interpret biological data, such as DNA sequences and protein structures. Bioinformatics plays a crucial role in genome sequencing, evolutionary biology, and personalized medicine by providing insights into genetic data through software applications.

Quick Tip

Remember: Bioinformatics combines biology and computer science to analyze DNA, proteins, and genomes.

(ii) Amniocentesis

Solution:

Amniocentesis is a prenatal diagnostic technique used to detect genetic disorders in the fetus by analyzing amniotic fluid.A small sample of amniotic fluid is extracted from the uterus using a needle to analyze fetal cells for chromosomal abnormalities such as Down's syndrome.

Quick Tip

Remember: Amniocentesis tests fetal health by analyzing amniotic fluid; used for detecting genetic disorders.

Long Answer Type Questions

7. Explain the features required to facilitate cloning into a vector.

Solution:

A cloning vector must possess specific features to efficiently introduce foreign DNA into host cells for replication and expression.

Key features of a cloning vector:

1. **Origin of replication (Ori):** Ensures self-replication within the host cell.
2. **Selectable marker:** Allows identification of recombinant cells (e.g., antibiotic resistance genes).
3. **Multiple cloning sites (MCS):** Contains restriction enzyme recognition sites for insertion of foreign DNA.
4. **Promoter and terminator sequences:** Regulate gene expression within the host.

Quick Tip

Remember: Essential vector features include Ori (replication), marker genes (selection), and MCS (insertion sites).

OR Describe the dihybrid cross with the help of a checker-board.

Solution:

A dihybrid cross studies the inheritance of two different traits simultaneously. According to Mendel's law of independent assortment, the alleles for different traits segregate independently during gamete formation.

Example: Cross between a pea plant with round yellow seeds (RRYY) and one with wrinkled green seeds (rryy).

	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

The phenotypic ratio obtained is 9:3:3:1.

Quick Tip

Remember: A dihybrid cross follows a 9:3:3:1 phenotypic ratio; traits assort independently during gamete formation.

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8. Describe the processes of triple fusion in angiospermic plants.

Solution:

Triple fusion is a key process in the fertilization of angiosperms, where one sperm nucleus fuses with two polar nuclei to form a triploid (3n) endosperm.

Steps of triple fusion:

1. Pollen tube releases two male gametes into the embryo sac.
2. One sperm fertilizes the egg, forming the diploid zygote.
3. The other sperm fuses with two polar nuclei, forming the triploid primary endosperm nucleus (PEN).
4. The endosperm nourishes the developing embryo.

Quick Tip

Remember: Triple fusion in angiosperms results in 3n endosperm, which provides nutrition to the developing embryo.

OR Write short notes on the following:

(a) Lymphocytes in human blood

Solution:

Lymphocytes are a type of white blood cells (WBCs) that play a crucial role in immune responses. They are of two types:

- **B-lymphocytes:** Produce antibodies to fight infections.
- **T-lymphocytes:** Help in cell-mediated immunity by destroying infected cells.

Quick Tip

Remember: B-lymphocytes produce antibodies; T-lymphocytes attack infected cells and regulate immunity.

(b) Convergent evolution

Solution:

Convergent evolution occurs when unrelated species evolve similar traits due to adaptation to similar environmental conditions.

Example: Wings of birds and bats serve the same function but evolved independently.

Quick Tip

Remember: Convergent evolution = similar features in unrelated species due to adaptation (e.g., wings in birds and bats).

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9. Write an essay on Biosphere Reserves and National Parks.

Solution:

Biosphere Reserves:

Biosphere reserves are designated areas aimed at conserving biodiversity, promoting research, and supporting sustainable development. They consist of three zones:

- **Core Zone:** Fully protected, with no human interference.
- **Buffer Zone:** Limited human activity is allowed for research and education.
- **Transition Zone:** Sustainable human activities like agriculture are encouraged.

Examples in India include the Nilgiri Biosphere Reserve and Sundarbans Biosphere Reserve.

National Parks:

National parks are protected areas established by governments to conserve wildlife and natural habitats. Activities like hunting, grazing, and deforestation are strictly prohibited. Some notable national parks in India are Jim Corbett National Park and Kaziranga National Park.

Importance of Biosphere Reserves and National Parks:

- Conservation of flora and fauna.
- Protection of endangered species.
- Promotion of ecotourism and research.

Quick Tip

Remember: Biosphere reserves have core, buffer, and transition zones; national parks strictly protect wildlife and do not allow human activities.

OR Write short notes on the following:

(a) Applications and future challenges of the Human Genome Project

Solution:

Applications:

- Identification of disease-causing genes and development of targeted therapies.
- Advances in personalized medicine and genetic counseling.
- Understanding human evolution and migration patterns.
- Improvement in forensic science through DNA fingerprinting.

Future Challenges:

- Ethical concerns regarding genetic privacy and discrimination.
- High costs associated with genome sequencing and data analysis.
- Managing the vast amount of genomic data effectively.

Quick Tip

Remember: The Human Genome Project helps in disease diagnosis and personalized medicine; challenges include ethical issues and data management.

(b) Infectious diseases

Solution:

Infectious diseases are caused by pathogenic microorganisms such as bacteria, viruses, fungi, and parasites. They can spread from one person to another through air, water, direct contact, or vectors.

Examples of infectious diseases:

- **Bacterial:** Tuberculosis (caused by *Mycobacterium tuberculosis*)
- **Viral:** Influenza (caused by influenza virus)
- **Parasitic:** Malaria (caused by *Plasmodium*)

Prevention and Control:

- Maintaining proper hygiene and sanitation.
- Vaccination to provide immunity against infections.
- Proper use of antibiotics and antiviral drugs under medical supervision.

Quick Tip

Remember: Infectious diseases spread through air, water, and contact; prevention includes hygiene, vaccination, and proper medication.
