

UP Board Class 12 Biology 2026 (Set 348 EI) Question Paper with Solutions



General Instructions

- (i) This booklet contains 9 questions, each provided with a complete, step-by-step solution.
- (ii) It comprises 4 single-correct multiple-choice questions.
- (iii) Attempt each question on your own before reviewing the given solution.

1(a). The sudden discontinuation of the regular dose of drug/alcohol causes:

- (A) Turner syndrome
- (B) Deficiency syndrome
- (C) Withdrawal syndrome
- (D) All of these

Correct Answer: (C) Withdrawal syndrome

Solution:

Step 1: Understanding the Concept:

Abrupt stopping of a habit-forming drug or alcohol after regular/dependent use produces a characteristic set of physical and psychological symptoms in the body, since the body has adapted to the substance's presence.

Step 2: Identifying the Term:

This specific cluster of symptoms that appears on sudden discontinuation of a drug/alcohol the body has become dependent on

is called withdrawal syndrome — it can include anxiety, tremors, nausea and, in severe cases, seizures.

Quick Tip: Recall the specific medical term for symptoms on sudden drug/alcohol cessation.

1(b). Citric acid is produced by:

- (A) *Aspergillus niger*
- (B) *Clostridium butylicum*
- (C) *Acetobacter aceti*
- (D) *Trichoderma polysporum*

Correct Answer: (A) *Aspergillus niger*

Solution:

Step 1: Understanding the Concept:

Several industrially important organic acids are produced commercially using microbial fermentation, each acid being associated with a specific, well-known industrial microorganism.

Step 2: Identifying the Organism:

Citric acid is industrially produced by fermentation using the fungus *Aspergillus niger*, which is grown on a sugar-rich medium under controlled conditions.

Quick Tip: Match each acid to its known industrial fermentation organism.

1(c). Which of the following statements explains parasitism?

- (A) Only one organism is benefitted
- (B) Both organisms are benefitted
- (C) Both organisms are harmed
- (D) Neither of both the organisms is benefitted or harmed

Correct Answer: (A) Only one organism is benefitted

Solution:

Step 1: Understanding the Concept:

Population interactions between two species are classified by whether each partner is helped (+), harmed (–), or unaffected (0). Parasitism is one such interspecific interaction.

Step 2: Applying it to Parasitism:

In parasitism, the parasite lives on or inside a host and derives nourishment from it, so the parasite is benefitted; the interaction is defined at this basic level by only one of the two organisms gaining an advantage.

Quick Tip: Recall the +/–/0 scoring used to classify population interactions.

1(d). Which of the following is known as universal codon?

- (A) AAA
- (B) CCC
- (C) GGG
- (D) UUU

Correct Answer: (D) UUU

Solution:

Step 1: Understanding the Concept:

Nirenberg and Matthaei's classic poly-U experiment (1961) used a synthetic RNA made only of uracil (UUUUU...) in a cell-free translation system to crack the very first codon of the genetic code.

Step 2: Identifying the Codon:

This experiment showed that the codon UUU codes for the amino acid phenylalanine, and because it was the first codon deciphered and is used with near-universal consistency across organisms, UUU is referred to as the universal codon.

Quick Tip: Recall which codon was decoded first, via the poly-U experiment.

2(a). What is cloning?

Correct Answer: —

Solution:

Step 1: Definition:

Cloning is the process of producing a large number of genetically identical copies (clones) of a cell, gene/DNA fragment, or a whole organism through asexual (non-sexual) means, so that every copy is an exact genetic replica of the original.

Step 2: Examples:

It includes molecular cloning of a gene into a vector, and whole-organism cloning such as the cloning of the sheep Dolly by the somatic cell nuclear transfer technique.

Quick Tip: Recall the meaning of producing genetically identical copies.



2(b). Which type of cell division occurs during cleavage?

Correct Answer: —

Solution:

Step 1: Understanding Cleavage:

After fertilisation, the zygote undergoes rapid, repeated divisions called cleavage as it travels through the fallopian tube towards the uterus, forming a multicellular ball called the morula.

Step 2: Identifying the Division Type:

These rapid divisions are mitotic divisions — each division produces daughter cells (blastomeres) with the same chromosome number as the zygote, without an intervening growth phase.

Quick Tip: Recall which division type preserves chromosome number while increasing cell count rapidly.



2(c). Name the gases which were used by S.L. Miller in the experiment of origin of life.

Correct Answer: —

Solution:

Step 1: Background:

In 1953, Stanley L. Miller created a laboratory apparatus simulating the early reducing atmosphere of the primitive Earth, to test whether simple organic (prebiotic) molecules could form spontaneously under such conditions.

Step 2: The Gas Mixture Used:

He used a mixture of methane (CH_4), ammonia (NH_3), hydrogen (H_2), and water vapour (H_2O), circulated past an electric spark (simulating lightning) at about 800°C .

Quick Tip: Recall the four-gas reducing-atmosphere mixture used in this classic experiment.



2(d). Write the names of any two biodiversity hot-spots.

Correct Answer: —

Solution:

Step 1: Definition Recap:

A biodiversity hotspot is a biogeographic region with a significant reservoir of species (especially endemic ones) that is simultaneously facing serious threat of habitat loss.

Step 2: Two Examples:

Two well-known biodiversity hotspots are the Western Ghats-Sri

Lanka hotspot and the Indo-Burma hotspot (the Himalaya is another commonly cited example).

Quick Tip: Recall any two named biodiversity hotspots covering India.

2(e). What is sporopollenin?

Correct Answer: —

Solution:

Step 1: Where it is Found:

Sporopollenin is the material that makes up the exine, the hard outer wall of a pollen grain in flowering plants.

Step 2: Its Key Property:

It is one of the most resistant organic materials known — it can withstand high temperatures, and strong acids and alkalis, and no enzyme capable of degrading it is known, which is why pollen exine is well preserved as fossils.

Quick Tip: Recall the name of the tough biopolymer forming pollen exine.

3(a). What is Mendelian disorder?

Correct Answer: —

Solution:

Step 1: Definition:

A Mendelian disorder is a disease or disorder caused by an alteration or mutation in a single gene, so that the disorder is transmitted from parents to offspring following the classical Mendelian patterns of inheritance (dominant, recessive, X-linked, etc.).

Step 2: Examples:

Common examples include colour blindness, haemophilia, sickle-cell anaemia, thalassemia, and phenylketonuria; family pedigree analysis is commonly used to trace the inheritance pattern of such disorders across generations.

Quick Tip: Recall the definition tying single-gene mutation to Mendelian inheritance patterns.



3(b). Write a note on organic farming.

Correct Answer: —

Solution:**Step 1: Concept:**

Organic farming is a method of crop and livestock production that avoids or largely excludes the use of synthetic chemical fertilisers, pesticides, and growth regulators.

Step 2: Practices Used:

It relies instead on natural inputs such as compost, vermicompost, farmyard manure, biofertilisers (e.g., *Rhizobium*, *Azotobacter*), crop

rotation, and biological pest control (e.g., use of *Trichoderma*, Bt-based biopesticides) to maintain soil fertility and manage pests.

Quick Tip: Recall what organic farming avoids and what it relies on instead.



3(c). Write the causes of loss of biodiversity.

Correct Answer: —

Solution:

Step 1: The Four Major Causes ('Evil Quartet'):

Ecologists commonly summarise the main causes of biodiversity loss as four factors, sometimes called the 'Evil Quartet': habitat loss and fragmentation, over-exploitation of species, invasion by alien/exotic species, and co-extinction.

Step 2: Brief Explanation of Each:

Habitat loss (e.g., deforestation) destroys living space; over-exploitation (e.g., overfishing, overhunting) reduces population below recovery levels; alien species invasion (e.g., water hyacinth) outcompetes native species; co-extinction occurs when the extinction of one species (e.g., a host) causes the extinction of an obligately dependent species (e.g., its specific parasite/pollinator).

Quick Tip: Recall the 'Evil Quartet' of biodiversity-loss causes.



3(d). Write a note on biological control of pests and diseases.

Correct Answer: —

Solution:

Step 1: Concept:

Biological control uses living organisms — natural predators, parasites, or pathogens of a pest — to keep the pest population in check, instead of using chemical pesticides.

Step 2: Examples:

Ladybird beetles and dragonflies are used to control aphids and mosquitoes respectively; the bacterium *Bacillus thuringiensis* (Bt) produces toxins lethal to specific insect larvae and is used as a biopesticide (and in Bt crops); the fungus *Trichoderma* is used as a biocontrol agent against several plant pathogens; baculoviruses are used as narrow-spectrum, species-specific insecticidal agents.

Quick Tip: Recall specific organisms used against specific pests/pathogens.

3(e). Draw a labelled diagram of T.S. of a mature dithecal anther.
(described in words, as a text-only labelled description)

Correct Answer: —

Solution:

Step 1: Overall Structure:

A transverse section (T.S.) of a mature dithecal anther shows two anther lobes (thecae) connected in the middle by a sterile connective tissue that also carries the vascular strand supplying the anther.

Step 2: Wall Layers (Outside to Inside) of Each Lobe:

Each anther lobe, from outside inward, has: (1) epidermis (protective outer layer), (2) endothecium (fibrous layer aiding anther dehiscence), (3) 2-3 middle layers, and (4) tapetum (innermost nutritive layer surrounding the pollen sac and nourishing developing pollen grains); at the centre of each lobe lie one or two pollen sacs, each containing numerous microspores/pollen grains.

Quick Tip: Recall the four wall layers of an anther lobe, from outside to inside.

4(a). Write the importance of cross pollination.

Correct Answer: —

Solution:**Step 1: What Cross Pollination Means:**

Cross pollination (xenogamy) is the transfer of pollen grains from the anther of one flower to the stigma of a genetically different flower/plant of the same species.

Step 2: Why it Matters:

It introduces genetic variation by combining genetic material from two different parent plants, producing offspring with new/heterozygous gene combinations (hybrid vigour); this raises the population's adaptability to changing environments and can mask/eliminate harmful recessive traits by combining them with healthy dominant alleles.

Quick Tip: Recall how bringing together genetically different parents affects offspring.



4(b). Write a short note on water pollinated plants.

Correct Answer: —

Solution:

Step 1: Concept:

In hydrophily (water pollination), water acts as the pollinating agent, transporting pollen grains from the anther to the stigma; this mode is rare, seen in fewer than 1% of angiosperm species.

Step 2: Examples and Adaptations:

In *Vallisneria* and *Hydrilla*, pollen grains are released onto the water surface and carried passively to reach the stigma; in fully submerged marine forms such as *Zostera*, pollen grains are long, filiform, and released directly underwater, often protected by a mucilaginous covering to prevent damage from wetting.

Quick Tip: Recall named examples of surface vs. underwater hydrophily.



4(c). Describe sterilisation in detail.

Correct Answer: —

Solution:

Step 1: What Sterilisation Is:

Sterilisation is a terminal (permanent) surgical method of contraception that blocks the transport of gametes so that fertilisation cannot occur.

Step 2: The Two Procedures:

In males, it is called vasectomy — a small part of the vas deferens is cut and tied/sealed on both sides through a small incision or puncture in the scrotum, blocking sperm transport into the ejaculate. In females, it is called tubectomy — a small part of each fallopian tube (oviduct) is cut and tied/sealed through an incision in the abdomen or vagina, blocking the ovum from meeting sperm.

Quick Tip: Recall the male vs. female sterilisation procedure names and what each duct does normally.



4(d). Describe the strategies for reproductive health.

Correct Answer: —

Solution:**Step 1: Government/Programme-Level Strategies:**

India's Reproductive and Child Health Care (RCH) programmes provide education, counselling, medical assistance, and facilities to people for building a reproductively healthy society, covering prenatal and postnatal care, safe delivery, contraceptive awareness, and treatment of infertility.

Step 2: Education and Awareness Strategies:

These include introducing sex education in schools to provide correct information about reproductive organs, adolescence, safe sexual practices, and STDs; creating awareness among the general public and medical/paramedical personnel about various reproduction-related issues; and encouraging people to overcome social taboos around discussing sex-related matters openly.

Quick Tip: Recall the mix of government programmes and awareness/education measures.

5(a). Describe allele and multiple allele.

Correct Answer: —

Solution:

Step 1: Allele:

An allele is one of two or more alternative forms of a gene that occupy the same locus on homologous chromosomes and govern the same trait; e.g., in the pea plant, the gene for stem height has a tall allele (T) and a dwarf allele (t).

Step 2: Multiple Allele:

When a single gene exists in more than two allelic forms within a population (though any one diploid individual carries only two of them), it is called multiple alleles; the classic example is the human ABO blood group, controlled by gene I with three alleles — I^A , I^B , and i.

Quick Tip: Recall the ABO blood group as the standard multiple-allele example.

5(b). Explain transfer RNA in brief.

Correct Answer: —

Solution:

Step 1: Structure:

Transfer RNA (tRNA) is a small RNA molecule, typically 75-90 nucleotides long, that folds into a characteristic cloverleaf secondary structure with several base-paired stem-loop regions.

Step 2: Function in Translation:

It acts as an adaptor molecule: one end (the anticodon loop) has a triplet of bases that pairs specifically with a complementary codon on mRNA, while the other end (the 3' CCA acceptor end) is charged with the specific amino acid corresponding to that codon; each type of tRNA is specific for one particular amino acid, and it physically carries that amino acid to the ribosome to be added to the growing polypeptide chain.

Quick Tip: Recall the two functional ends of the tRNA cloverleaf: anticodon loop and amino-acid acceptor end.

5(c). What is evolution? Write two evidences of evolution.

Correct Answer: —

Solution:

Step 1: Definition:

Evolution is the gradual, heritable change in the characteristics of a population of organisms over successive generations, through which new species arise from pre-existing ones (descent with modification).

Step 2: Evidence 1 — Fossil Record:

The fossil record, when arranged by geological age, shows a progressive sequence from simpler to more complex organisms and displays transitional forms (e.g., the fossil sequence in horse evolution), directly documenting change over time.

Quick Tip: Recall the fossil record and homologous-organ evidence as classic proofs of evolution.



5(d). What do you understand by Widal test? Describe.

Correct Answer: —

Solution:

Step 1: What it Detects:

The Widal test is a serological (blood-based) diagnostic test used to detect typhoid fever, which is caused by the bacterium *Salmonella typhi*.

Step 2: How it Works:

It is based on the antigen-antibody agglutination reaction: the patient's blood serum is mixed with known O and H antigens of *Salmonella typhi*; if the patient has been infected, their serum

contains specific antibodies (agglutinins) that bind and visibly clump (agglutinate) these antigens, and the pattern/titre of agglutination indicates the presence and stage of typhoid infection.

Quick Tip: Recall that the Widal test diagnoses typhoid via antigen-antibody agglutination.



6(a). Write a note on Ganga action plan.

Correct Answer: —

Solution:

Step 1: Background and Aim:

The Ganga Action Plan (GAP) was launched by the Government of India in 1985 to reduce the pollution load on the river Ganga, which had become heavily polluted with domestic sewage and industrial effluents discharged by towns and cities along its course.

Step 2: Measures Taken:

The plan involved intercepting and diverting raw sewage flowing into the river to treatment plants, setting up sewage treatment plants, and requiring industries along the river to treat their effluents to meet prescribed standards before discharge, in order to restore the river's water quality to at least bathing-water standard.

Quick Tip: Recall the year (1985) and the core sewage/effluent-interception approach of GAP.



6(b). Describe DNA fingerprinting technique in brief.

Correct Answer: —

Solution:

Step 1: Principle:

DNA fingerprinting is a technique that identifies differences in certain highly variable, repetitive DNA sequences (variable number tandem repeats, VNTRs) that are unique to every individual (except identical twins), even though most of the genome is identical between individuals.

Step 2: Procedure:

DNA is isolated from a sample (blood, hair root, etc.), cut into fragments using restriction endonucleases, separated by size using gel electrophoresis, and then hybridised (Southern blotting) with a labelled VNTR probe; this produces a unique pattern of bands — the 'DNA fingerprint' — specific to that individual.

Quick Tip: Recall that VNTR variability, revealed via restriction digestion + gel electrophoresis + hybridisation, gives the unique pattern.

6(c). How would you produce pest resistant plants?

Correct Answer: —

Solution:

Step 1: Genetic Engineering Approach:

Pest-resistant plants are produced by genetically engineering crop plants to carry and express a gene from the soil bacterium *Bacillus*

thuringiensis (Bt) that codes for a protein toxic to specific insect pests, such as the *cry* genes (e.g., *cryIAc*, *cryIAb*).

Step 2: How the Toxin Works:

The *cry* gene is introduced into the plant's genome so the plant itself produces the Bt toxin protein in its tissues; when a susceptible insect larva feeds on the plant, the toxin binds to its midgut cells, causing them to swell and lyse, killing the insect, while the toxin is harmless to non-target organisms including humans.

Quick Tip: Recall Bt cotton and the cry-gene toxin mechanism as the standard example.



6(d). Which type of population interaction is found in lichen? Describe.

Correct Answer: —

Solution:

Step 1: Identifying the Interaction:

Lichen represents mutualism, an interspecific interaction in which both participating species benefit from the association.

Step 2: The Two Partners and Their Roles:

A lichen is formed by an intimate association between a fungus and a photosynthetic partner (a green alga or a cyanobacterium); the fungal partner provides a protective structure, absorbs water and minerals, and shields the photosynthetic partner, while the algal/cyanobacterial partner uses photosynthesis to manufacture food that is shared with the fungus.

Quick Tip: Recall lichen = fungus + alga/cyanobacterium, a classic mutualism example.



7. Write an essay on population stabilization.

Correct Answer: —

Solution:

Step 1: What Population Stabilization Means:

Population stabilization refers to bringing the growth rate of a population down to a level (ideally close to zero net growth) that matches sustainably with the availability of resources, rather than allowing unchecked exponential growth.

Step 2: Key Strategies:

Major strategies include promoting family planning and wider availability/awareness of contraceptive methods, delaying the age of marriage, encouraging adequate spacing between children, offering incentives for adopting the small-family norm, and improving literacy — especially female literacy — since educated women tend to have smaller families.

Quick Tip: Recall the mix of contraception, education, healthcare, and government-policy strategies.

OR

State detail account of any two drugs obtained from plants and their effect.

Correct Answer: —

Solution:

Step 1: Drug 1 — Cannabinoids from *Cannabis sativa*:

Cannabinoids (such as those found in marijuana, hashish, charas and ganja) are obtained from the inflorescence of the plant *Cannabis sativa*; these chemicals interact with cannabinoid receptors present mainly in the brain, and their effects include altering mood and perception, and affecting the cardiovascular system of the body.

Step 2: Drug 2 — Opioids from *Papaver somniferum*:

Opioids such as morphine and heroin (smack) are obtained from the latex of the opium poppy plant, *Papaver somniferum*; morphine is a powerful sedative/pain-killer used medically, but these drugs act as depressants that slow down body functions, and heroin in particular is highly addictive and can cause fatal respiratory depression on overdose.

Quick Tip: Recall the source plant, active compound class, and physiological effect for each drug.

8. Describe the sex determination in human and honeybee.

Correct Answer: —

Solution:

Step 1: Sex Determination in Humans (XX-XY type):

In humans, sex is determined chromosomally: females are homogametic (XX) and males are heterogametic (XY). All eggs produced by the mother carry a single X chromosome, but sperm are of two types — half carry an X chromosome and half carry a Y

chromosome. If an X-carrying sperm fertilises the egg, the zygote is XX and develops into a female; if a Y-carrying sperm fertilises the egg, the zygote is XY and develops into a male — so it is the father's sperm that determines the offspring's sex.

Step 2: Sex Determination in Honeybee (Haplodiploidy):

Honeybees do not have sex chromosomes at all; sex is determined by chromosome number (ploidy). Fertilised, diploid eggs (32 chromosomes) develop into females (queens or worker bees, depending on diet/feeding), while unfertilised, haploid eggs (16 chromosomes) develop into males (drones) through parthenogenesis — drones therefore have no father and produce only genetically identical sperm.

Quick Tip: Recall XX/XY chromosomal determination in humans vs. haplodiploidy in honeybees.

OR

What is primary productivity? Discuss in brief the factors affecting the primary productivity.

Correct Answer: —

Solution:

Step 1: Definition:

Primary productivity is the amount of biomass or organic matter produced by autotrophs (mainly green plants) per unit area over a given period of time through photosynthesis; Gross Primary Productivity (GPP) is the total rate of production, while Net Primary Productivity (NPP) is GPP minus the biomass lost to the plant's own

respiration.

Step 2: Environmental Factors:

Primary productivity depends on the availability of sunlight (light intensity and duration), temperature, and water availability (rainfall), all of which regulate the rate of photosynthesis.

Quick Tip: Recall GPP vs NPP, and the light/temperature/water/nutrient/CO₂ factors governing photosynthesis rate.



9. Describe the applications of biotechnology in agriculture.

Correct Answer: —

Solution:

Step 1: Pest and Herbicide Resistance:

Biotechnology has enabled the development of genetically modified (GM) crops such as Bt cotton, which carries a *cry* gene from *Bacillus thuringiensis* making the plant produce its own insecticidal toxin against bollworms, reducing dependence on chemical pesticides; herbicide-tolerant crops have also been developed so that weeds can be controlled without harming the crop plant itself.

Step 2: Improved Nutrition and Disease Resistance:

GM technology has been used to improve the nutritional quality of crops, such as Golden Rice, which is engineered to produce beta-carotene (a Vitamin A precursor) to address Vitamin A deficiency; virus-resistant transgenic crops have also been developed, such as

papaya resistant to the papaya ringspot virus using RNA interference (RNAi)-based technology.

Quick Tip: Recall Bt cotton, Golden Rice, and RNAi-based virus resistance as concrete GM-crop examples.

OR

Describe negative interactions in plants with example.

Correct Answer: —

Solution:

Step 1: Competition:

Competition is a negative interaction in which two or more plant species compete for the same limited resource — such as light, water, space, or soil nutrients — and both are adversely affected by each other's presence, since the presence of one reduces the resource available to the other.

Step 2: Allelopathy:

Allelopathy is another negative interaction, in which one plant releases chemical substances (allelochemicals) into the environment that inhibit the germination or growth of nearby plants; for example, *Parthenium* (congress grass) releases allelochemicals that suppress the growth of neighbouring crop plants, and *Eucalyptus* trees are known to release substances that inhibit the growth of undergrowth vegetation around them.

Quick Tip: Recall competition (shared limited resource) and allelopathy (chemical inhibition, e.g. *Parthenium*) as the two negative interactions.