

MHT CET 2018 Paper 3 Biology Answer Key PDF

Question 1 Option: (A) – Cambia of both stock and scion fuse together

Explanation: Grafting requires the vascular cambium of both the stock and scion to come into direct physical contact. This alignment allows them to fuse, establishing a continuous vascular system for water and nutrient transport.

Question 2 Option: (D) – Hyaluronic acid

Explanation: Cellulose, starch, and glycogen are homopolysaccharides consisting solely of repeating glucose monomers. In contrast, hyaluronic acid is a heteropolysaccharide made of alternating D-glucuronic acid and N-acetyl-D-glucosamine units.

Question 3 Option: (A) – Leaf curl and chilli mosaic virus

Explanation: 'Pusa Sadabahar' is a disease-resistant cultivar of chilli developed by breeding techniques. It is specifically bred to resist pathogenic infections caused by Chilli mosaic virus, Tobacco mosaic virus, and Leaf curl.

Question 4 Option: (B) – Imbibition

Explanation: Imbibition is a physical process where water molecules are adsorbed by hydrophilic solid colloids like cellulose and pectin present in the cell wall of root hairs, causing the cell wall to swell.

Question 5 Option: (D) – Decarboxylation

Explanation: In the Krebs cycle, the enzyme isocitrate dehydrogenase catalyzes the conversion of the six-carbon compound oxalosuccinate into the five-carbon compound α -ketoglutarate by releasing a molecule of carbon dioxide.

Question 6 Option: (A) – Lillium

Explanation: S.G. Nawaschin first discovered double fertilization in angiosperms in 1898. He made this landmark observation while investigating the fertilization processes in *Lilium martagon* and *Fritillaria tenella*.

Question 7 Option: (D) – Respiration

Explanation: Oxidative phosphorylation is the primary metabolic pathway responsible for producing ATP in eukaryotic organisms. It takes place within the inner mitochondrial membrane during the aerobic stages of cellular respiration.

Question 8 Option: (C) – Incomplete dominance

Explanation: Snapdragon (*Antirrhinum majus*) is a classic example of incomplete dominance, where crossing homozygous red-flowered and white-flowered parents results in an F1 generation consisting of pink-flowered heterozygotes.

Question 9 Option: (D) – H_1

Explanation: The core octamer of a nucleosome contains two molecules of each of the histones H_{2A} , H_{2B} , H_3 , and H_4 . The linker histone H_1 binds to the DNA externally as a single molecule per nucleosome.

Question 10 Option: (C) – The upper branch of bifurcated connective bears sterile anther lobe and lower branch bears fertile anther lobe

Explanation: In *Salvia*, the lever mechanism features a bifurcated connective with unequal arms. The upper, longer branch bears a fertile anther lobe, while the lower, shorter branch bears a sterile anther lobe.

Question 11 Option: (A) – Dried spores of *Bacillus thuringiensis* are sprayed on its vulnerable leaves

Explanation: Bt cotton is a genetically modified transgenic plant containing the *cry* gene

from *Bacillus thuringiensis*. The plant generates the insecticidal protein internally, rendering external spraying of bacterial spores unnecessary.

Question 12 Option: (B) – Secondary nucleus is a sister nucleus of the egg

Explanation: The fusion of a male gamete with the diploid secondary nucleus is termed triple fusion or second fertilization. The polar nuclei that form the secondary nucleus share a common genetic lineage as sister cells to the egg.

Question 13 Option: (D) – 100%

Explanation: In *Mirabilis jalapa*, flower color exhibits incomplete dominance. Crossing homozygous red (*RR*) and white (*rr*) varieties produces an F1 generation that is entirely heterozygous pink (*Rr*), yielding 100% pink flowers.

Question 14 Option: (C) – Restriction endonuclease

Explanation: Restriction endonucleases are specialized bacterial enzymes used in recombinant DNA technology to cut DNA. They cleave the double-stranded DNA at precise, specific palindromic recognition sequences.

Question 15 Option: (D) – Garhwal Himalayas

Explanation: The Chipko Movement was a non-violent, rural movement focused on forest conservation. It originated in 1973 in the Reni village of the Chamoli district situated in the Garhwal Himalayas of Uttarakhand.

Question 16 Option: (A) – Delaying the onset of senescence by application of cytokinin

Explanation: The Richmond-Lang effect describes the physiological phenomenon where external application of cytokinins delays the degradation of chlorophyll and proteins, thereby postponing senescence in detached leaves.

Question 17 Option: (A) – RBC

Explanation: Sick cell anemia is an autosomal recessive genetic disorder where mutated hemoglobin molecules polymerize. This causes red blood cells (RBCs) to deform from their normal biconcave shape into a characteristic half-moon shape.

Question 18 Option: (D) – Throughout life

Explanation: Cellular respiration is a fundamental metabolic process required to generate ATP for cellular maintenance. Because plants continually require metabolic energy, respiration occurs continuously in all living cells throughout their lifespan.

Question 19 Option: (C) – UAC

Explanation: In translation, the universal start codon on the mRNA is 5'-AUG-3'. The initiator tRNA carries the complementary anticodon 3'-UAC-5' to base-pair with the start codon and initiate protein synthesis.

Question 20 Option: (A) – Government

Explanation: A biopatent is a legally enforceable intellectual property right. It is formally granted to an inventor by a national government or designated patent authority, providing exclusive rights to biological inventions.

Question 21 Option: (C) – Sporopollenin

Explanation: The outer wall layer (exine) of a pollen grain is composed of sporopollenin. This highly robust lipid-like polymer is extremely resistant to physical, chemical, and biological degradation, protecting the male gametophyte.

Question 22 Option: (D) – Cohesive force between H_2O molecules and transpiration pull

Explanation: According to the cohesion-tension theory, transpiration pull creates a tension gradient that draws water upward. This continuous water column is stabilized by strong cohesive forces between polar water molecules.

Question 23 Option: (B) – They are naturally found in bacteria only

Explanation: Plasmids are small, extrachromosomal circular DNA molecules. While highly

common in prokaryotes like bacteria, they are also found naturally in some eukaryotic organisms, such as the 2-micron plasmid of yeast.

Question 24 Option: (C) – *Chlorella* and *Scenedesmus*

Explanation: Melvin Calvin used the radioactive carbon isotope ^{14}C on the unicellular green algae *Chlorella* and *Scenedesmus* to map the enzymatic steps of carbon fixation in the light-independent reactions of photosynthesis.

Question 25 Option: (D) – Slime mould

Explanation: Desmids, dinoflagellates, and diatoms are photosynthetic, plant-like organisms belonging to the kingdom Protista. Slime moulds are fungus-like, consumer-decomposer protists characterized by an amoeboid vegetative phase.

Question 26 Option: (C) – Always infinity

Explanation: The Respiratory Quotient (RQ) is the ratio of CO_2 produced to O_2 consumed. Because anaerobic respiration does not consume any oxygen ($\text{O}_2 = 0$), dividing the CO_2 output by zero yields an infinite RQ.

Question 27 Option: (D) – Favours evolution

Explanation: Self-pollination leads to increased homozygosity and maintains genetic purity within a lineage. Because it limits genetic recombination and prevents the introduction of new variations, self-pollination does not favor evolution.

Question 28 Option: (A) – Convert monomers to organic acids

Explanation: In anaerobic digestion inside a biogas plant, acidogenic bacteria convert the simple soluble monomers produced during hydrolysis into short-chain volatile fatty acids, predominantly acetic acid.

Question 29 Option: (D) – Photorespiration

Explanation: Photorespiration occurs in C_3 plants when the RuBisCO enzyme binds with oxygen rather than carbon dioxide. This oxygenase activity leads to the breakdown of organic carbon, releasing fixed CO_2 back into the atmosphere.

Question 30 Option: (D) – i

Explanation: The regulator (*i*) gene in the lac operon is constitutively expressed. It transcribes the repressor mRNA, which is translated to produce the active repressor protein that regulates transcription based on glucose availability.

Question 31 Option: (D) – Presence of xylem vessels

Explanation: The evolutionary development of specialized xylem vessel elements provided angiosperms with a highly efficient water-conducting system. This adaptation supported larger growth forms and promoted their dominance across terrestrial ecosystems.

Question 32 Option: (C) – The BOD of effluent increases after secondary treatment

Explanation: Secondary sewage treatment utilizes aerobic microorganisms to decompose suspended organic matter. This biological process significantly reduces, rather than increases, the Biochemical Oxygen Demand (BOD) of the wastewater.

Question 33 Option: (A) – Hypogeal

Explanation: During hypogeal germination, rapid elongation of the embryonic epicotyl pulls the plumule upward out of the soil while the cotyledons remain stationary beneath the ground surface.

Question 34 Option: (B) – 9

Explanation: A standard Mendelian dihybrid cross for two independently assorting loci yields a phenotypic ratio of 9:3:3:1 in the F_2 generation, which corresponds to exactly nine distinct genotypic combinations.

Question 35 Option: (D) – Increase in crop production

Explanation: Global warming causes extreme weather patterns, prolonged droughts, and shifts

in pest distributions. These ecological disruptions negatively impact agricultural yields, leading to a general reduction in global crop production.

Question 36 Option: (B) – Cytochrome $b_6 \rightarrow$ Cytochrome f

Explanation: During cyclic photophosphorylation, the downhill transfer of electrons from Cytochrome b_6 to Cytochrome f releases energy, which is coupled with proton pumping to synthesize ATP.

Question 37 Option: (B) – Two mitotic divisions

Explanation: The development of a mature male gametophyte from a microspore involves two mitotic divisions: the first produces a vegetative and a generative cell, and the second divides the generative cell into two male gametes.

Question 38 Option: (C) – Angiospermae

Explanation: Kingdom, Series, and Genus are abstract taxonomic categories (ranks) used in classification hierarchy. Angiospermae is not a category but a specific taxon classified under the category of Sub-division/Division.

Question 39 Option: (D) – 5

Explanation: To ensure complete genetic homozygosity and establish true-breeding parental lines, Gregor Mendel self-pollinated his pea plants for 5 to 6 successive generations before performing cross-hybridization experiments.

Question 40 Option: (B) – *Thermus aquaticus*

Explanation: Taq polymerase is a highly heat-stable DNA polymerase utilized in the Polymerase Chain Reaction (PCR). It is isolated from the thermophilic bacterium *Thermus aquaticus*, which flourishes in high-temperature hot springs.

Question 41 Option: (D) – Production of genetically dissimilar plants

Explanation: Vegetative propagation is an asexual reproduction method. Since cell division occurs exclusively by mitosis, the resulting progeny are clonal replicates of the parent, which preserves genetic uniformity rather than creating dissimilarity.

Question 42 Option: (C) – Active outside the host's body

Explanation: Viruses lack metabolic machinery and cellular structures. Consequently, they behave as inert, non-living particles outside a host organism and exhibit biological activity only upon infecting a susceptible host cell.

Question 43 Option: (D) – NADP

Explanation: During the light-dependent reactions of photosynthesis, the oxidized co-enzyme NADP^+ acts as the terminal electron and hydrogen acceptor, reducing to NADPH, which is then used in the carbon-fixation cycle.

Question 44 Option: (B) – DNA $\rightarrow$ Transcription $\rightarrow$ Translation $\rightarrow$ Protein

Explanation: The Central Dogma of molecular biology defines the directional flow of genetic information: DNA is first transcribed into mRNA (Transcription), which is then translated by ribosomes into a functional polypeptide (Translation).

Question 45 Option: (B) – 38

Explanation: The complete theoretical aerobic respiration of a single molecule of glucose yields a total of 38 ATP molecules (or 36 in certain tissues, depending on the mitochondrial shuttle system used for cytosolic NADH).

Question 46 Option: (C) – Nodes

Explanation: The potato tuber is a structurally modified underground stem. The “eyes” found on its surface represent nodes containing axillary buds, which are capable of sprouting to form new vegetative shoots.

Question 47 Option: (C) – Providing protection from UV rays

Explanation: The stratospheric ozone layer functions as a protective shield. It absorbs the

high-energy ultraviolet (UV) radiation from solar emissions, protecting living organisms from DNA damage and cellular mutations.

Question 48 Option: (A) – Carbon atom arranged in four inter-locking rings

Explanation: Steroids are structurally characterized by a carbon skeleton comprising seventeen carbon atoms arranged in a fused tetracyclic ring system, consisting of three cyclohexane rings and one cyclopentane ring.

Question 49 Option: (A) – Blue, violet and red

Explanation: Chlorophyll a and chlorophyll b are the primary photosynthetic pigments. They show distinct absorption peaks in the high-energy blue-violet and red regions of the electromagnetic visible spectrum.

Question 50 Option: (B) – Apical meristem

Explanation: Apical meristems are generally free of viral pathogens due to active cell division, rapid growth, and the absence of vascular connections, making them the preferred explant for producing virus-free plants in tissue culture.

Question 51 Option: (B) – Apical meristem

Explanation: Culturing the apical meristem is widely used to obtain disease-free clonal lines. Meristematic cells undergo rapid division and lack mature vascular bundles, preventing the systemic spread of viral particles.

Question 52 Option: (1) – P - iv, Q - iii, R - i, S - ii

Explanation: The coronary sinus is guarded by the Thebesian valve, the systemic aorta features semilunar valves at its base, the left AV valve is the mitral valve, and the Eustachian valve guards the opening of the inferior vena cava.

Question 53 Option: (4) – Natality increases and emigration decreases

Explanation: Population density increases when new individuals are added through births (natality) or immigration, and when the rate of individuals departing the population (emigration) decreases.

Question 54 Option: (1) – 16

Explanation: Linkage groups correspond to the haploid chromosome count of an organism. Because male honeybees (drones) are haploid with $n = 16$ chromosomes, there are exactly 16 linkage groups.

Question 55 Option: (2) – Kidney

Explanation: Erythropoietin (EPO) is a peptide hormone synthesized and secreted by the specialized peritubular interstitial cells of the kidney in response to low oxygen tension (hypoxia) in the blood.

Question 56 Option: (1) – Cytochromes, dehydrogenases, flavoproteins

Explanation: The inner mitochondrial membrane houses the Electron Transport Chain (ETC), where flavoproteins, various dehydrogenases, and cytochromes act as co-enzymes and electron carriers to drive ATP synthesis.

Question 57 Option: (3) – HCG

Explanation: Human Chorionic Gonadotropin (HCG) levels peak around the end of the first trimester to maintain the corpus luteum. During the second trimester, HCG production declines as the placenta takes over hormone synthesis.

Question 58 Option: (4) – Homo neanderthalensis

Explanation: Neanderthal man (*Homo neanderthalensis*) was a heavily built prehistoric hominid with a robust, stocky skeleton and a large cranial capacity averaging about 1450 cc.

Question 59 Option: (4) – Corpora striata

Explanation: The corpora striata are large subcortical structures of the basal ganglia located

in the ventrolateral walls of the cerebral hemispheres, involved in coordinating voluntary motor movements.

Question 60 Option: (3) – Carboxyhaemoglobin

Explanation: Carbon monoxide binds to the iron centers in hemoglobin with an affinity much higher than oxygen. This competitive binding produces a highly stable chemical complex called carboxyhemoglobin.

Question 61 Option: (2) – Antigen binding site

Explanation: In the basic structure of an immunoglobulin (antibody), the variable regions situated at the amino-terminal ends of the heavy and light chains form the specific antigen-binding pocket.

Question 62 Option: (3) – Second polar body

Explanation: The final step of oogenesis is completed only when a sperm fertilizes the secondary oocyte. This event triggers the completion of Meiosis II, which is marked by the extrusion of the second polar body.

Question 63 Option: (2) – Female banded krait

Explanation: Dr. Lalji Singh isolated the Bkm (Banded Krait Minor) DNA probe from the sex-determining W chromosome of the female banded krait snake to develop indigenous DNA fingerprinting techniques.

Question 64 Option: (1) – Zoological parks

Explanation: In-situ conservation preserves species in their natural habitats (e.g., national parks, sanctuaries). Zoological parks are ex-situ conservation efforts where animals are maintained outside their natural ecosystems.

Question 65 Option: (1) – Goblet cell

Explanation: Goblet cells are specialized mucus-secreting epithelial cells found in the lining of the respiratory and digestive tracts, functioning as simple, functional unicellular exocrine glands.

Question 66 Option: (1) – Follicular cells

Explanation: Ovarian estrogen is primarily synthesized and released by the granulosa and theca cells (follicular cells) of developing ovarian follicles under the regulatory control of gonadotropins.

Question 67 Option: (3) – Human females have double dose of X chromosome

Explanation: Human females possess two X chromosomes (XX), providing a double gene dosage compared to human males (XY). Male drone bees develop parthenogenetically and produce sperm via mitotic cell division.

Question 68 Option: (4) – Myocardial infarction

Explanation: A heart attack is medically termed a myocardial infarction. It is caused by a sudden, complete blockage of a coronary artery, leading to ischemic necrosis of the downstream cardiac muscle tissue.

Question 69 Option: (1) – Archeozoic

Explanation: The prebiotic synthesis of organic molecules, early chemical evolution, and the origin of the earliest primitive life-forms occurred approximately 3.5 to 3.8 billion years ago during the Archeozoic (Archaean) era.

Question 70 Option: (2) – Catecholamines

Explanation: The region marked 'X' represents the adrenal medulla, which is derived from the embryonic neural crest. It synthesizes and secretes the stress hormones epinephrine and norepinephrine (catecholamines).

Question 71 Option: (4) – Leucoplast — Photosynthesis

Explanation: Leucoplasts are non-pigmented plastids specialized for storing nutrient reserves

like starch (amyloplasts), lipids (elaioplasts), or proteins (aleuroplasts). Photosynthesis is carried out exclusively by chloroplasts.

Question 72 Option: (3) – Klinefelter's syndrome

Explanation: Klinefelter's syndrome is a chromosomal abnormality characterized by the presence of an extra sex chromosome in males (47,XXY), leading to altered secondary sexual characteristics and sterility.

Question 73 Option: (1) – X - Smooth endoplasmic reticulum, Y - Rough endoplasmic reticulum

Explanation: In eukaryotic cells, the rough endoplasmic reticulum (Y) is characterized by membrane-bound ribosomes, whereas the smooth endoplasmic reticulum (X) lacks ribosomes and is involved in lipid synthesis.

Question 74 Option: (3) – On the side of visceral organs

Explanation: Parasympathetic preganglionic fibers extend long axons that synapse in terminal ganglia located close to, or directly within the muscular wall of, the targeted visceral organs.

Question 75 Option: (4) – Sucrase, Maltase, Dipeptidase

Explanation: Succus entericus contains brush border enzymes of the small intestine, including disaccharidases (sucrase, maltase) and peptidases (dipeptidase). Trypsin, amylase, and chymotrypsin are secreted by the pancreas.

Question 76 Option: (4) – Larynx

Explanation: The Adam's apple is a prominent subcutaneous anatomical feature formed by the thyroid cartilage, which partially houses and protects the larynx (the primary vocal apparatus).

Question 77 Option: (1) – Tunica media

Explanation: The region labeled 'X' corresponds to the middle muscular coat of an artery, known as the tunica media, which consists of smooth muscle cells and elastic tissue to handle blood pressure.

Question 78 Option: (2) – Growth of Graafian follicle

Explanation: Follicle-Stimulating Hormone (FSH), secreted by the anterior pituitary, stimulates the growth, cellular proliferation, and development of primary ovarian follicles into mature Graafian follicles.

Question 79 Option: (1) – Natural acquired active

Explanation: Surviving a naturally contracted infection like measles stimulates the host's B and T lymphocytes to produce antibodies and memory cells, establishing lifelong natural acquired active immunity.

Question 80 Option: (3) – Galapagos Islands

Explanation: During his voyage on the HMS Beagle, Charles Darwin studied several closely related species of finches on the Galapagos Islands, which served as a classic demonstration of adaptive radiation.

Question 81 Option: (1) – Oedema of lower legs and face

Explanation: Severe oedema of the face and lower limbs is a key diagnostic symptom of Kwashiorkor (protein deficiency). Marasmus is characterized by extreme emaciation, dry skin, and muscle wasting without swelling.

Question 82 Option: (2) – Dryopithecus

Explanation: Archaeopteryx, Ichthyostegia, and Seymouria are transitional fossil links showing shared traits between distinct classes. *Dryopithecus* is an extinct miocene ape that represents a direct ancestor of hominids.

Question 83 Option: (4) – Yolk-sac

Explanation: Primordial germ cells, which undergo mitotic proliferation to form oogonia in

the female embryo, originate in the endodermal layer of the extraembryonic yolk sac before migrating to the gonadal ridge.

Question 84 Option: (2) – Fatty acids and glycerol

Explanation: Lacteals are specialized lymphatic capillaries situated in the intestinal villi. They are responsible for absorbing digested lipids (fatty acids and glycerol) that have been reconstituted into chylomicrons.

Question 85 Option: (1) – L

Explanation: The label 'L' represents the glomerulus, a network of fenestrated capillaries within the Malpighian body where ultrafiltration of blood occurs under hydrostatic pressure.

Question 86 Option: (2) – Calcium oxalate, calcium phosphate

Explanation: The vast majority of clinically diagnosed kidney stones (renal calculi) consist of insoluble crystalline precipitates, primarily composed of calcium oxalate combined with calcium phosphate.

Question 87 Option: (1) – 1 to 4

Explanation: The human testis is divided into approximately 250 functional compartments called lobules, and each lobule contains one to four highly coiled seminiferous tubules where sperm cells are generated.

Question 88 Option: (2) – Based on fingerprints of individual

Explanation: DNA fingerprinting is a molecular technique used to analyze variable regions of DNA, such as minisatellites. It is not based on the physical, dermal ridge patterns of skin fingerprints.

Question 89 Option: (3) – Isinglass

Explanation: Lac is an animal-derived natural resin used to make varnishes, inks, and toys. Isinglass is a purified collagen substance extracted from the swim bladders of fish, used for clarifying beverages.

Question 90 Option: (3) – Penguin, Spider, Scorpion

Explanation: Guanotelic animals excrete nitrogenous wastes primarily in the form of insoluble guanine. This metabolic adaptation for water conservation is typically found in arachnids (spiders, scorpions) and certain birds like penguins.

Question 91 Option: (2) – Epithelial

Explanation: Epithelial tissues line body surfaces and cavities and are avascular, meaning they lack blood vessels. They obtain oxygen and metabolic nutrients via simple diffusion from the underlying capillary beds of connective tissues.

Question 92 Option: (3) – Emphysema

Explanation: Human α -1-antitrypsin is a glycoprotein that protects lung tissues from elastase degradation. Transgenic production of this protein is used to treat genetic emphysema caused by its deficiency.

Question 93 Option: (1) – Secretory phase

Explanation: During the secretory (luteal) phase of the menstrual cycle, the newly formed corpus luteum secretes high concentrations of progesterone, which peaks around day 21 to facilitate endometrial thickening.

Question 94 Option: (4) – Short generation time

Explanation: Mice are highly efficient model organisms for transgenesis because they have a short gestation period, reach sexual maturity quickly, have a short generation time, and produce large litters.

Question 95 Option: (2) – Aerial

Explanation: Hollow pneumatic bones and the presence of a single, functional left ovary are key weight-reducing adaptations designed to facilitate flight in avian species (aerial adaptation).

Question 96 Option: (2) – Planaria

Explanation: Flatworms belonging to the genus *Planaria* exhibit an exceptionally high capacity for regeneration, where any severed piece of the body can reorganize and regrow into a complete organism.

Question 97 Option: (1) – Arbor vitae

Explanation: The arbor vitae is the internal white matter of the cerebellum. It is arranged in a branching, tree-like structure that is surrounded by the outer cerebellar gray cortex.

Question 98 Option: (2) – Haversian canal

Explanation: The label 'X' indicates the central Haversian canal, which forms the core of an osteon in compact mammalian bone and contains blood vessels, lymphatics, and nerve fibers.

Question 99 Option: (1) – Cirrhina

Explanation: *Cirrhina* (such as *Cirrhina mrigala*) is a genus of freshwater carps native to major river systems of South Asia, whereas *Harpadon*, *Sardinella*, and *Rastrelliger* are marine species.

Question 100 Option: (4) – Papaver somniferum

Explanation: Heroin (diacetylmorphine) is a semi-synthetic opioid derivative synthesized from morphine. Morphine is obtained directly from the latex harvested from the unripe seed pods of the opium poppy, *Papaver somniferum*.