NEET Biology Sample Paper 03

A) Subject: Biology
B) Total Questions: 50 Questions (All Compulsory)
C) Marking Scheme & Rules:

- Correct Answer: +4 marks
- Incorrect Answer: -1 mark (Negative marking)
- Unattempted Question: 0 marks
- Multiple Answers: Treated as incorrect, attracting -1 mark

Botany (Section A)

Q1. Which of the following taxonomic categories includes all the others listed below for a mango plant?

A. Sapindales

B. Anacardiaceae

C. Dicotyledonae

D. Angiospermae

Q2. Select the wrong statement regarding Diatoms:

A. They are chief producers in the oceans.

B. Their walls are indestructible due to silica.

C. They float passively in water currents (plankton).

D. They belong to the kingdom Monera.

Q3. Mycoplasmas are different from other bacteria because they:

A. Possess a thick cell wall.

B. Lack a cell wall and can survive without oxygen.

C. Are always autotrophic.

D. Have a nucleus with a nuclear membrane.

Q4. In which of the following plants does the stem modify into a flattened, green, photosynthetic structure called a phylloclade?

A. Opuntia

B. Euphorbia

C. Casuarina

D. All of the above

Q5. Match the following columns regarding root modifications:

A. (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

B. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

C. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

D. (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

Q6. The casparian strip is found in the:

A. Epidermis

B. Pericycle

C. Endodermis

D. Pith

Q7. Which of the following statements is incorrect regarding the anatomy of a monocot leaf?

A. It is an isobilateral leaf.

B. Mesophyll is differentiated into palisade and spongy parenchyma.

C. Stomata are present on both surfaces.

D. Vascular bundles are nearly similar in size.

Q8. According to the fluid mosaic model, the "quasi-fluid" nature of lipids enables:

A. Lateral movement of proteins within the bilayer.

B. Movement of carbohydrates across the membrane.

C. Stability of the cell wall.

D. Formation of the nuclear envelope.

Q9. Crossing over between homologous chromosomes occurs during which stage of Meiosis I?

A. Zygotene

B. Pachytene

C. Diplotene

D. Leptotene

Q10. What will be the direction of net water movement between cell A ($\Psi_w = -10$ bars) and cell B ($\Psi_w = -4$ bars)?

A. From A to B

B. From B to A

C. No net movement

D. Water will move to cell with lower solute potential

Q11. Which element is essential for the photolysis of water during photosynthesis?

A. Magnesium

B. Manganese

C. Molybdenum

D. Copper

Q12. In the chemiosmotic hypothesis, the proton gradient is established across the:

A. Outer mitochondrial membrane

B. Inner mitochondrial membrane

C. Thylakoid membrane

D. Plasma membrane

Q13. The Respiratory Quotient (RQ) of tripalmitin (a fat) is approximately:

A. 1.0

B. 0.9

C. 0.7

D. 1.4

Q14. Which hormone is known as the "stress hormone" in plants because it stimulates the closure of stomata?

A. Auxin

B. Gibberellin

C. Abscisic acid

D. Cytokinin

Q15. Cleistogamous flowers are:

A. Wind pollinated

B. Water pollinated

C. Self-pollinated (Invariably autogamous)

D. Insect pollinated

Q16. The coconut water from a tender coconut represents:

A. Free nuclear endosperm

B. Cellular endosperm

C. Endocarp

D. Fleshy mesocarp

Q17. A test cross is performed to:

A. Determine the phenotype of an F1 plant.

B. Determine the genotype of an F2 plant showing a dominant phenotype.

C. Predict the number of offspring.

D. Verify the Law of Independent Assortment.

Q18. If a double-stranded DNA has 20% Cytosine, what will be the percentage of Adenine in it?

A. 20%

B. 30%

C. 40%

D. 80%

Q19. Which of the following is not a stop codon?

A. UAA

B. UAG

C. UGA

D. UGG

Q20. The process of RNA-induced silencing of a specific mRNA is known as:

A. RNA translation

B. RNA interference

C. RNA splicing

D. RNA transcription

Q21. In sewage treatment, the "activated sludge" is:

A. Settled bacterial flocs from the secondary settling tank.

B. Floating debris from primary treatment.

C. Grit from primary treatment.

D. Sludge that has been chemically treated.

Q22. Which restriction enzyme produces "sticky ends" from the following?

A. EcoRV

B. SmaI

C. EcoRI

D. PvuII

Q23. The pyramid of biomass in a sea ecosystem is generally:

A. Upright

B. Inverted

C. Spindle-shaped

D. Horizontal

Q24. "Sacred groves" are especially useful in:

A. Generating environmental awareness.

B. Conserving rare and threatened species.

C. Year-round flow of water in rivers.

D. Preventing soil erosion.

Q25. Accelerated eutrophication of water bodies is primarily caused by the runoff of:

A. Nitrates and Phosphates

B. Mercury and Lead

C. Silt and Sand

D. Oil and Grease

Zoology (Section B)

Q26. Radial symmetry is observed in:

A. Coelenterata

B. Ctenophora

C. Adult Echinodermata

D. All of the above

Q27. Identify the mismatched pair regarding animal tissues:

A. Adipose tissue — Loose connective tissue

B. Osteocytes — Bone cells

C. Areolar tissue — Dense connective tissue

D. Blood — Fluid connective tissue

Q28. Chylomicrons are:

A. Undigested proteins in the stomach

B. Protein-coated fat globules transported into lymph

C. Small droplets of glycerol in the intestine

D. Enzymes that breakdown fats

Q29. The partial pressure of oxygen (pO_2) in the alveoli of the lungs is:

A. Equal to that in the deoxygenated blood

B. More than that in the atmospheric air

C. More than that in the oxygenated blood

D. Less than that in the tissues

Q30. Which of the following clotting factors is known as the "Christmas Factor"?

A. Factor VIII

B. Factor IX

C. Factor XI

D. Factor XII

Q31. The "Counter-current mechanism" essential for concentrating urine involves:

A. Henle's loop and Vasa recta

B. PCT and DCT

C. Glomerulus and Bowman's capsule

D. Collecting duct only

Q32. The pivot joint between the atlas and axis vertebrae is a type of:

A. Cartilaginous joint

B. Synovial joint

C. Fibrous joint

D. Saddle joint

Q33. The transparent lens in the human eye is held in place by:

A. Smooth muscles of the iris

B. Ligaments attached to the ciliary body

C. Fibers attached to the cornea

D. Vitreous humor pressure

Q34. Receptors for protein hormones (like Insulin) are typically located:

A. In the cytoplasm

B. On the cell surface (membrane-bound)

C. Inside the nucleus

D. On the mitochondrial membrane

Q35. Capacitation refers to the physiological changes in:

A. Ovum before fertilization

B. Ovum after fertilization

C. Sperm before fertilization

D. Sperm after fertilization

Q36. Which hormone(s) reach peak levels during the middle of a 28-day menstrual cycle (around day 14)?

A. LH

B. FSH

C. Estrogen

D. All of the above

Q37. Surgical methods of contraception (Vasectomy/Tubectomy) primarily prevent:

A. Gamete formation

B. Gamete transport

C. Ovulation

D. Spermatogenesis

Q38. The theory "Ontogeny recapitulates phylogeny" was proposed as the Biogenetic Law by:

A. Ernst Haeckel

B. Charles Darwin

C. Jean-Baptiste Lamarck

D. Hugo de Vries

Q39. The most significant evolutionary trend from human ancestors to modern man is:

A. Upright posture

B. Shortening of the jaws

C. Binocular vision

D. Increasing cranial capacity

Q40. Colostrum, the yellowish fluid secreted by a mother during the initial days of lactation, provides the infant with:

A. Active immunity

B. Passive immunity

C. Innate immunity

D. Auto-immunity

Q41. Match the disease with its causative agent:

A. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

B. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

C. (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)

D. (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

Q42. In the Polymerase Chain Reaction (PCR), the "Annealing" step occurs at approximately:

A. $94°C$

B. $54°C$

C. $72°C$

D. $100°C$

Q43. The first transgenic cow, Rosie, produced milk that was enriched with:

A. Human alpha-lactalbumin

B. Human insulin

C. Vitamin A

D. Human beta-globin

Q44. In the MOET (Multiple Ovulation Embryo Transfer) program, the cow is administered hormones with FSH-like activity to induce:

A. Super ovulation

B. Immediate parturition

C. High milk yield

D. Twin pregnancy

Q45. Competitive inhibition of an enzyme occurs when:

A. The inhibitor binds to an allosteric site.

B. The inhibitor is a structural analogue of the substrate.

C. The primary structure of the enzyme is altered.

D. The enzyme is denatured by heat.

Q46. Which of the following is a characteristic feature of all Chordates?

A. Presence of a vertebral column

B. Presence of a ventral heart

C. Presence of a dorsal hollow nerve cord

D. Presence of a closed circulatory system

Q47. Identify the correct statement:

A. All mammals are viviparous.

B. Cyclostomes lack jaws and paired fins.

C. All reptiles have a four-chambered heart.

D. All bony fishes (Osteichthyes) lack an operculum.

Q48. An antibody molecule is represented structurally as:

A. H_2L_2

B. H_1L_1

C. H_4L_4

D. H_2L_4

Q49. Which of the following was not a goal of the Human Genome Project (HGP)?

A. Identify all genes in human DNA.

B. Determine the sequence of 3 billion base pairs.

C. Use information to clone human beings.

D. Address ethical, legal, and social issues (ELSI).

Q50. The use of bio-resources by multinational companies without proper authorization from the countries and people concerned is termed:

A. Bio-infringement

B. Bio-piracy

C. Bio-remediation

D. Bio-ethics

Solutions

1. **(D)** In the taxonomic hierarchy, "Angiospermae" is the Division, which is a higher category that includes the Class (Dicotyledonae), Order (Sapindales), and Family (Anacardiaceae) for a mango plant (Mangifera indica).

2. **(D)** Diatoms are members of the group Chrysophytes under the Kingdom Protista, not Monera. They are characterized by silica-embedded "soap-box" like cell walls.

3. **(B)** Mycoplasmas are the smallest living cells known. They completely lack a cell wall, which makes them naturally resistant to antibiotics like penicillin that target cell wall synthesis. They can survive without oxygen.

4. **(D)** In arid regions, some plants modify their stems into green, succulent structures called phylloclades to perform photosynthesis. Opuntia (flattened), Euphorbia (cylindrical), and Casuarina all exhibit this modification.

5. **(A)** • Tap roots of Carrot: Storage of food. • Hanging roots of Banyan: Prop roots (support). • Roots of Rhizophora: Pneumatophores (respiration in swampy areas). • Roots of Maize: Stilt roots (arising from lower nodes for support).

6. **(C)** The endodermis of the root contains a layer of water-impermeable, waxy material called suberin in the form of Casparian strips, which prevents the apoplastic movement of water into the vascular cylinder.

7. **(B)** In an isobilateral (monocot) leaf, the mesophyll is usually not differentiated into palisade and spongy parenchyma. This differentiation is a characteristic feature of dorsiventral (dicot) leaves.

8. **(A)** According to Singer and Nicolson's fluid mosaic model, the quasi-fluid nature of the lipid bilayer allows for the lateral movement of proteins within the overall bilayer. This ability to move within the membrane is measured as its fluidity.

9. **(B)** Crossing over, the exchange of genetic material between non-sister chromatids of homologous chromosomes, occurs during the Pachytene stage of Prophase I.

10. **(B)** Water always moves from a region of higher water potential (less negative) to a region of lower water potential (more negative). Since -4 bars is higher than -10 bars, water moves from Cell B to Cell A.

11. **(B)** The splitting of water (photolysis) during the light reaction of photosynthesis requires Manganese (Mn^{2+}) and Chlorine (Cl^{-}) ions to release electrons, protons, and oxygen.

12. **(C)** According to the chemiosmotic hypothesis, the proton gradient is established across the thylakoid membrane in chloroplasts (and the inner mitochondrial membrane in mitochondria) to drive ATP synthesis.

13. **(C)** The Respiratory Quotient (RQ) is the ratio of CO_2 evolved to O_2 consumed. For fats like tripalmitin, the RQ is roughly 0.7 (for carbohydrates it is 1.0, and for proteins it is 0.9).

14. **(C)** Abscisic acid (ABA) is called the stress hormone because it increases the tolerance of plants to various kinds of stresses, most notably by inducing the closure of stomata during water scarcity.

15. **(C)** Cleistogamous flowers do not open at all. Since the anthers and stigma lie close to each other, when anthers dehisce in the flower buds, pollen grains come in contact with the stigma to effect pollination, making them invariably autogamous.

16. **(A)** In a tender coconut, the coconut water is actually free-nuclear endosperm (made up of thousands of nuclei), while the surrounding white kernel is the cellular endosperm.

17. **(B)** A test cross involves crossing an individual with a dominant phenotype (but unknown genotype) with a homozygous recessive parent to determine if the individual is homozygous or heterozygous.

18. **(B)** According to Chargaff's rule, $A+G=T+C$ and $A=T$, $G=C$. If $C=20\%$, then $G=20\%$. Total $C+G=40\%$. This leaves 60% for $A+T$. Since $A=T$, then $A=30\%$.

19. **(D)** The universal stop codons are UAA, UAG, and UGA. UGG is the start-adjacent codon that specifically codes for the amino acid Tryptophan.

20. **(B)** RNA interference (RNAi) involves the silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA.

21. **(A)** In the secondary treatment of sewage, the sediment that contains vigorous growth of aerobic bacteria and fungi (flocs) is called activated sludge. A small part of this is pumped back into the aeration tank as inoculum.

22. **(C)** EcoRI cuts DNA at the sequence G/AATTC, leaving overhanging single-stranded stretches called sticky ends. EcoRV and SmaI produce blunt ends.

23. **(B)** In many aquatic ecosystems (like the sea), the pyramid of biomass is inverted because the biomass of fishes (consumers) far exceeds the biomass of phytoplanktons (producers).

24. **(B)** Sacred groves are tracts of forest that are protected due to religious or cultural beliefs. They often serve as a last refuge for many rare and threatened plant species.

25. **(A)** Eutrophication is the natural aging of a lake by biological enrichment of its water. Runoff from agricultural fields containing nitrates and phosphates (fertilizers) accelerates this process, leading to algal blooms.

26. **(D)** Radial symmetry is characteristic of Coelenterates (Cnidarians), Ctenophores, and adult Echinoderms. It is important to note that larval stages of Echinoderms exhibit bilateral symmetry.

27. **(C)** Areolar tissue is a type of loose connective tissue. Dense connective tissues are those where fibers and fibroblasts are compactly packed, such as in tendons and ligaments.

28. **(B)** Chylomicrons are very small, protein-coated fat globules formed in the intestinal mucosa. They are transported into the lymph vessels (lacteals) in the villi to eventually reach the blood.

29. **(C)** The partial pressure of oxygen (pO_2) in the alveoli is approximately 104 mm Hg. This is higher than the pO_2 in oxygenated blood (95 mm Hg), deoxygenated blood (40 mm Hg), and tissues (40 mm Hg).

30. **(B)** Factor IX is also known as the Christmas factor. A deficiency in this factor leads to Hemophilia B, or Christmas disease.

31. **(A)** The counter-current mechanism is essential for producing concentrated urine. It involves the flow of filtrate in the two limbs of the loop of Henle and the flow of blood in the two limbs of the vasa recta in opposite directions.

32. **(B)** The pivot joint, such as the one between the atlas and axis vertebrae, is a type of synovial joint. These joints are characterized by a fluid-filled synovial cavity between the articulating surfaces of the bones.

33. **(B)** The lens is a transparent, crystalline structure that is held in its place within the eye by suspensory ligaments attached to the ciliary body.

34. **(B)** Protein and peptide hormones are not lipid-soluble and cannot enter the target cell. Their receptors are located on the cell surface (plasma membrane), where they initiate a secondary messenger system.

35. **(C)** Capacitation is the process of functional maturation that sperm must undergo within the female reproductive tract before they are capable of fertilizing an ovum.

36. **(D)** During the middle of the menstrual cycle (the ovulatory phase), the secretion of LH reaches its maximum (LH surge). Levels of FSH and Estrogen also peak during this time to facilitate ovulation.

37. **(B)** Surgical methods like vasectomy (in males) and tubectomy (in females) are highly effective contraceptive methods that work by blocking the transport of gametes through the reproductive tracts.

38. **(A)** Ernst Haeckel proposed the Biogenetic Law, famously summarized as "ontogeny recapitulates phylogeny," which suggests that an organism's development repeats the evolutionary history of its species.

39. **(D)** The most significant evolutionary trend in the lineage leading to modern humans is the progressive increase in brain size, or cranial capacity.

40. **(B)** Colostrum is rich in antibodies (specifically IgA) that provide the infant with immediate immunity against various pathogens. This is a form of passive immunity because the antibodies are produced by the mother.

41. **(A)** Typhoid: Salmonella typhi Pneumonia: Streptococcus pneumoniae Malaria: Plasmodium falciparum Filariasis: Wuchereria bancrofti

42. **(B)** During the annealing step of PCR, primers bind to the complementary sequences on the single-stranded DNA templates. This step typically occurs at a temperature of around $54°C$.

43. **(A)** 'Rosie' was the first transgenic cow, produced in 1997. Her milk was enriched with human alpha-lactalbumin (2.4 grams per liter), making it more nutritionally suitable for human babies than ordinary cow milk.

44. **(A)** Multiple Ovulation Embryo Transfer (MOET) involves administering hormones with FSH-like activity to a cow to induce super-ovulation, resulting in the production of 6–8 eggs instead of one.

45. **(B)** Competitive inhibition occurs when an inhibitor molecule resembles the substrate in its molecular structure and competes with it for the active site of the enzyme.

46. **(C)** The primary characteristics of the Phylum Chordata include the presence of a notochord, a dorsal hollow nerve cord, and paired pharyngeal gill slits.

47. **(B)** Cyclostomes, such as lampreys, are primitive jawless vertebrates. They are characterized by a circular, sucking mouth and a lack of paired fins and scales.

48. **(A)** An antibody molecule consists of four peptide chains: two small light chains and two longer heavy chains. This structure is typically represented as H_2L_2.

49. **(C)** The Human Genome Project aimed to sequence the human genome, identify genes, and address ethical issues. Human cloning was not a stated goal or objective of the project.

50. **(B)** Bio-piracy is the use of bio-resources by multinational companies or other organizations without proper authorization from the countries or people concerned, often without compensatory payment.