PGIMER B.SC NURSING SAMPLE PAPER 05

A) Time Allowed: 1 Hour 30 Minutes.
B) Maximum Marks: 100
C) Total Questions: 100

General Instructions:

- This question paper consists of five sections: Physics, Chemistry, Biology, English, and General Knowledge.
- Each section contains objective type questions with four multiple-choice options (A, B, C, D).
- +1 mark is awarded for each correct answer and 0.25 marks are deducted for each wrong answer.
- The question paper is available in English language only.

SECTION 1 - BIOLOGY

Q1. During the light-dependent reactions of photosynthesis, what is the exact operational sequence of electron transport from the initial electron donor to the final electron acceptor?

(a) Water $\rightarrow$ Photosystem I $\rightarrow$ Plastocyanin $\rightarrow$ Cytochrome b_6f complex $\rightarrow$ Plastoquinone $\rightarrow$ Photosystem II $\rightarrow$ Ferredoxin $\rightarrow$ $NADP^+$

(b) Water $\rightarrow$ Photosystem II $\rightarrow$ Plastoquinone $\rightarrow$ Cytochrome b_6f complex $\rightarrow$ Plastocyanin $\rightarrow$ Photosystem I $\rightarrow$ Ferredoxin $\rightarrow$ $NADP^+$

(c) $NADP^+$ $\rightarrow$ Photosystem II $\rightarrow$ Plastoquinone $\rightarrow$ Cytochrome b_6f complex $\rightarrow$ Plastocyanin $\rightarrow$ Photosystem I $\rightarrow$ Ferredoxin $\rightarrow$ Water

(d) Water $\rightarrow$ Photosystem II $\rightarrow$ Plastocyanin $\rightarrow$ Plastoquinone $\rightarrow$ Cytochrome b_6f complex $\rightarrow$ Photosystem I $\rightarrow$ $NADP^+$ $\rightarrow$ Ferredoxin

Q2. Which specific hormonal combination and concentrations must be added to a plant tissue culture medium to promote rapid shoot proliferation from an undifferentiated mass of callus tissue?

(a) High auxin concentration relative to cytokinin

(b) High cytokinin concentration relative to auxin

(c) High gibberellin concentration coupled with low abscisic acid

(d) Equal concentration of auxin and abscisic acid

Q3. What primary mechanism prevents polyspermy during human fertilization immediately following the binding of the first sperm head to the oocyte plasma membrane?

(a) The rapid influx of sodium ions (Na^+) causing depolarization of the oocyte membrane

(b) The exocytosis of cortical granules triggering the hardening of the zona pellucida via modification of ZP proteins

(c) The immediate destruction of all surrounding spermatozoa by maternal hydrolytic enzymes

(d) The rapid shrinking of the perivitelline space driven by osmotic loss of intracellular water

Q4. In a legal paternity case, an infant is determined to have blood group O (I^oI^o) and is positive for the Rh factor. Which of the following parental phenotypic pairings can definitely exclude a male candidate from being the biological father?

(a) Mother has blood group A (Rh positive); Father candidate has blood group AB (Rh negative)

(b) Mother has blood group O (Rh negative); Father candidate has blood group B (Rh positive)

(c) Mother has blood group B (Rh positive); Father candidate has blood group A (Rh positive)

(d) Mother has blood group O (Rh positive); Father candidate has blood group O (Rh negative)

Q5. What is the exact functional role performed by the complex enzyme Aminoacyl-tRNA Synthetase during the process of genetic translation?

(a) It catalyzes the formation of peptide bonds between amino acids aligned on the ribosomal A and P sites.

(b) It matches and covalently links a specific amino acid to its corresponding tRNA molecule using ATP energy.

(c) It scans the mRNA strand to locate the correct Shine-Dalgarno sequence for translation initiation.

(d) It cleaves the finished polypeptide chain from the tRNA complex during translation termination.

Q6. An isolated population of plants experiences a sudden chromosome doubling event due to meiotic non-disjunction, instantly creating fertile tetraploid offspring that can no longer cross-pollinate with the parental population. What type of speciation has occurred?

(a) Allopatric speciation

(b) Sympatric speciation

(c) Parapatric speciation

(d) Founders effect drift

Q7. Which of the following cellular structures or molecular zones functions as the definitive primary barrier limiting the filtration of large plasma proteins across the glomerular wall into Bowman's space?

(a) The fenestrations of the capillary endothelial cells

(b) The negatively charged slit diaphragms spanning the filtration slits between podocyte pedicels

(c) The epithelial lining of the proximal convoluted tubule

(d) The macula densa cellular array

Q8. How do C_4 plants successfully minimize the wasteful process of photorespiration under conditions of high ambient temperature and elevated light intensity?

(a) They fix carbon dioxide exclusively during the nighttime using Crassulacean Acid Metabolism.

(b) They use PEP carboxylase to initially fix CO_2 in mesophyll cells, spatially separating it from RuBisCO concentrated in bundle-sheath cells.

(c) They completely suppress the enzymatic activity of RuBisCO by substituting it with alternative transketolases.

(d) They reduce the total volume of vascular bundle sheath networks to lower local oxygen production.

Q9. What primary physiological mechanism is responsible for generating the absolute refractory period along an axon membrane during an action potential?

(a) The slow, prolonged opening of voltage-gated potassium (K^+) channels

(b) The closure of the time-dependent inactivation gates of voltage-gated sodium (Na^+) channels

(c) The active pumping rate of the Na^+/K^+ ATPase counter-transporter

(d) The mechanical closure of calcium-dependent synaptic vesicle arrays

Q10. In an aquatic ecosystem, a persistent chemical toxin undergoes biomagnification. Which trophic level is expected to exhibit the absolute highest concentration of this toxin per unit of tissue mass?

(a) Primary producers (Phytoplankton)

(b) Primary consumers (Zooplankton)

(c) Secondary consumers (Small fish)

(d) Tertiary or Apex consumers (Fish-eating birds / Eagles)

Q11. During the cardiac cycle, what specific mechanical event triggers the production of the first heart sound ("lubb") heard via auscultation?

(a) The closure of the semilunar valves at the start of ventricular diastole

(b) The closure of the atrioventricular (mitral and tricuspid) valves at the beginning of ventricular systole

(c) The rapid rushing of blood from the atria into relaxed ventricles

(d) The sudden contraction of the smooth muscles in the aortic wall

Q12. Which cellular component of the human innate immune system actively destroys virus-infected cells and tumor cells without requiring previous antigen presentation or antibody binding?

(a) Cytotoxic T-lymphocytes ($CD8^+$)

(b) Helper T-cells ($CD4^+$)

(c) Natural Killer (NK) cells

(d) Plasma cells

Q13. In genetic mapping experiments, what basic unit of physical measure defines the relative distance between two gene loci on a chromosome based on a 1% frequency of genetic recombination?

(a) Nanometer

(b) Centimorgan (cM)

(c) Base pair (bp)

(d) Angstrom

Q14. Which specific secondary messenger cascade is explicitly activated inside hepatocytes when the hormone epinephrine binds to its membrane-bound β-adrenergic G-protein coupled receptor?

(a) Cyclic adenosine monophosphate ($cAMP$) activation of Protein Kinase A
(b) Inositol trisphosphate (IP_3) release of calcium from the sarcoplasmic reticulum
(c) Direct activation of intracellular nuclear receptor domains
(d) Tyrosine kinase auto-phosphorylation

Q15. Under the classic five-kingdom classification system proposed by Robert Whittaker, which defining criterion acts as the ultimate structural dividing line to separate Monera from all other remaining kingdoms?

(a) The presence or absence of a cellular wall matrix
(b) The basic mode of nutritional intake (Autotrophic vs. Heterotrophic)
(c) The prokaryotic cellular organization lacking a membrane-bound nucleus
(d) The level of multicellular tissue differentiation

Q16. What is the correct chronological path taken by a drop of urine exiting the human body, tracing it from the collecting ducts of the functional kidney lobes?

(a) Renal pelvis $\rightarrow$ Ureter $\rightarrow$ Urinary Bladder $\rightarrow$ Urethra
(b) Ureter $\rightarrow$ Renal pelvis $\rightarrow$ Urethra $\rightarrow$ Urinary Bladder
(c) Urinary Bladder $\rightarrow$ Ureter $\rightarrow$ Renal pelvis $\rightarrow$ Urethra
(d) Renal pelvis $\rightarrow$ Urethra $\rightarrow$ Ureter $\rightarrow$ Urinary Bladder

Q17. The genetic regulatory mechanism known as the "Lac Operon" exhibits negative transcriptional control because the active regulatory gene product (repressor protein) blocks RNA polymerase by binding directly to the—

(a) Structural Z gene region
(b) Promoter sequence
(c) Operator locus
(d) CAP binding site

Q18. Which structural element within the vascular cambium cylinder is responsible for conducting water and dissolved nutrients radially across a woody dicot stem?

(a) Sieve tube elements
(b) Cambial fusiform initials
(c) Vascular ray initials
(d) Companion cells

Q19. The evolutionary phenomenon where different, unrelated species independently develop highly similar functional traits (such as the wings of insects and birds) due to adapting to identical environmental pressures is known as—

(a) Divergent evolution

(b) Convergent evolution

(c) Adaptive radiation

(d) Parallel co-speciation

Q20. In structural protein biochemistry, what specific chemical bonds are primarily responsible for maintaining and stabilizing the rigid structural coils of a protein's α-helix secondary structure?

(a) Covalent disulfide bridges between cysteine residues

(b) Hydrogen bonds formed between the carbonyl oxygen and amide nitrogen of the peptide backbone

(c) Hydrophobic core interactions among variable R-groups

(d) Ionic salt bridges between basic and acidic side chains

Q21. Which cellular junction type acts as an absolute seal between adjacent epithelial cells, preventing any localized leaking of extracellular fluids across tissue sheets?

(a) Gap junctions

(b) Adherens junctions

(c) Tight junctions (Zonula occludens)

(d) Desmosomes

Q22. What basic ecological rule establishes that warm-blooded mammals living in colder, high-latitude geographical environments tend to evolve shorter ears, limbs, and external appendages to minimize structural body heat dissipation?

(a) Allen's Rule

(b) Bergmann's Rule

(c) Gause's Principle

(d) Chargaff's Rules

Q23. During the process of human oogenesis, the primary oocytes are formed during embryonic development but remain arrested for years at which specific stage of cell division until puberty?

(a) Metaphase of Mitosis

(b) Prophase I of Meiosis I (specifically Diplotene)

(c) Metaphase II of Meiosis II

(d) Anaphase I of Meiosis I

Q24. Which enzyme is responsible for synthesizing short complementary primers of RNA during eukaryotic DNA replication, providing the necessary free 3'-OH group for elongation?

(a) DNA Polymerase I

(b) Topoisomerase

(c) DNA Primase

(d) Helicase

Q25. The respiratory parameter known as the ”Vital Capacity” (VC) of the human lungs is mathematically equal to the sum of which specific combination of respiratory volumes?

(a) Tidal Volume (TV) + Inspiratory Reserve Volume (IRV)

(b) Tidal Volume (TV) + Expiratory Reserve Volume (ERV)

(c) Tidal Volume (TV) + Inspiratory Reserve Volume (IRV) + Expiratory Reserve Volume (ERV)

(d) Residual Volume (RV) + Expiratory Reserve Volume (ERV)

SECTION 2 - CHEMISTRY

Q26. Under what conditions of temperature and pressure does a real gas deviate most significantly from ideal behavior?

(a) Low temperature and high pressure
(b) High temperature and low pressure
(c) High temperature and high pressure
(d) Low temperature and low pressure

Q27. Which of the following molecules features a central atom with exactly two bonding pairs and two lone pairs of electrons, resulting in a bent/V-shaped molecular geometry?

(a) CO_2
(b) SF_4
(c) ClF_3
(d) H_2S

Q28. What is the correct increasing order of the first ionization enthalpies for the period 2 elements Nitrogen, Oxygen, Carbon, and Fluorine?

(a) $C < N < O < F$
(b) $C < O < N < F$
(c) $O < C < N < F$
(d) $C < O < F < N$

Q29. For a reversible chemical reaction at equilibrium, what happens to the value of the equilibrium constant (K_{eq}) if a positive catalyst is introduced into the system?

(a) It increases proportionally
(b) It decreases significantly
(c) It remains completely unchanged
(d) It changes signs from positive to negative

Q30. What is the total number of unpaired electrons residing in the d-orbitals of a gaseous, ground-state Mn^{2+} ion ($Z = 25$)?

(a) 3
(b) 4
(c) 5
(d) 0

Q31. According to the de Broglie relationship, if an electron and a proton are moving at the exact same velocity, the wavelength associated with the electron will be—

(a) Identical to that of the proton

(b) Much shorter than that of the proton

(c) Much longer than that of the proton

(d) Zero

Q32. Which of the following crystalline solid defects is classified as a stoichiometric defect where an equal number of cations and anions are missing from their lattice sites, lowering the total density of the crystal?

(a) Frenkel defect

(b) Schottky defect

(c) Metal excess defect

(d) Interstitial defect

Q33. An aqueous solution of an organic solute freezes at $-0.372^{\circ}C$. If the molal freezing point depression constant (K_f) of water is $1.86 Kkgmol^{-1}$, what is the molality of the non-electrolyte solution?

(a) $0.1m$

(b) $0.2m$

(c) $0.5m$

(d) $1.0m$

Q34. During the industrial extraction of iron inside a blast furnace, which chemical substance acts as the primary reducing agent in the hottest zone to convert iron oxides into molten iron?

(a) CO_2

(b) C (Coke)

(c) CO (Carbon Monoxide)

(d) $CaCO_3$

Q35. What is the core chemical composition of the coordination complex known as "Wilkinson's Catalyst", widely utilized in the industrial hydrogenation of alkenes?

(a) $[Rh(PPh_3)_3Cl]$

(b) $[TiCl_4 + Al(C_2H_5)_3]$

(c) $[PdCl_2(PPh_3)_2]$

(d) $Fe(CO)_5$

Q36. Which of the following molecules will demonstrate a non-zero, permanent net dipole moment ($\mu \neq 0$) due to its asymmetric spatial architecture?

(a) BF_3

(b) CCl_4

(c) NF_3

(d) CO_2

Q37. What structural product is formed when phenol is heated with zinc dust at elevated temperatures?

(a) Cyclohexane

(b) Benzene

(c) Benzaldehyde

(d) Phenoxide ion

Q38. In a typical electrochemical cell, the absolute value of the standard cell potential (E°_{cell}) is related to the standard Gibbs free energy change (ΔG°) by which mathematical equation?

(a) $\Delta G^\circ = -nFE^\circ_{cell}$

(b) $\Delta G^\circ = nFE^\circ_{cell}$

(c) $\Delta G^\circ = -\frac{RT}{nF} \ln E^\circ_{cell}$

(d) $\Delta G^\circ = -nF \log E^\circ_{cell}$

Q39. Which of the following isomeric carbocations exhibits the highest degree of thermodynamic stability due to extensive hyperconjugation and inductive effects?

(a) $CH_3CH_2^+$

(b) $(CH_3)_2CH^+$

(c) $(CH_3)_3C^+$

(d) CH_3^+

Q40. The conversion of an alkyl halide into an alcohol via an aqueous alkali ($NaOH$) medium is chemically classified as what type of organic reaction?

(a) Electrophilic addition

(b) Nucleophilic substitution

(c) Nucleophilic addition

(d) Free radical substitution

Q41. What is the active chemical composition of the structural reagent known as "Tollens' Reagent", used in analytical chemistry to differentiate aldehydes from ketones?

(a) Alkaline solution of $CuSO_4$ containing sodium potassium tartrate

(b) Ammoniacal silver nitrate solution

(c) Acidified solution of potassium dichromate

(d) Iodine dissolved in potassium iodide solution

Q42. Which of the following polymers is chemically synthesized via a step-growth condensation polymerization mechanism, producing water or alcohol as a byproduct?

(a) Polyethylene
(b) Nylon-6,6
(c) Polystyrene
(d) PVC

Q43. What is the principal product obtained when an unbranched primary alcohol like propan-1-ol undergoes controlled chemical oxidation using Pyridinium Chlorochromate (PCC) in a dichloromethane solvent?

(a) Propanoic acid
(b) Propanal
(c) Propanone
(d) Propane gas

Q44. Under the IUPAC nomenclature rules, what is the systematic name assigned to the organic compound represented by the formula $CH_3 - CH(OH) - CH_2 - CHO$?

(a) 3-hydroxybutanal
(b) 2-hydroxybutanal
(c) 3-hydroxybutan-1-one
(d) 1-oxo-2-butanol

Q45. Which of the following nitrogenous bases is strictly unique to the molecular architecture of RNA molecules and is completely absent in native double-stranded DNA?

(a) Adenine
(b) Thymine
(c) Uracil
(d) Guanine

Q46. If the rate law expression for a specific chemical reaction is found to be $Rate = k[A]^1[B]^2$, what is the overall order of this reaction?

(a) 1
(b) 2
(c) 3
(d) 0

Q47. Which of the following oxoacids of Phosphorus contains a direct covalent Phosphorus-Phosphorus ($P - P$) bond within its structural skeleton?

(a) $H_4P_2O_7$ (Pyrophosphoric acid)

(b) $H_4P_2O_6$ (Hypophosphoric acid)

(c) H_3PO_3 (Orthophosphorous acid)

(d) $(HPO_3)_3$ (Cyclotriphosphoric acid)

Q48. What chemical product is formed when primary aliphatic amines are treated with a chilled solution of nitrous acid ($NaNO_2 + HCl$) at $0 - 5°C$?

(a) Highly stable diazonium salts

(b) Unstable diazonium salts that rapidly decompose to liberate Nitrogen gas and form alcohols

(c) Secondary nitroalkanes

(d) Insoluble yellow oily nitrosamines

Q49. According to the Hardy-Schulze rule for colloidal coagulation, which of the following ionic species possesses the highest flocculating power for the precipitation of a positively charged ferric hydroxide sol?

(a) Cl^-

(b) SO_4^{2-}

(c) $[Fe(CN)_6]^{4-}$

(d) PO_4^{3-}

Q50. Which of the following transition metal oxides demonstrates metallic electrical conductivity and behaves like a ferromagnetic material at room temperature?

(a) TiO_2

(b) CrO_2

(c) V_2O_3

(d) MnO_2

SECTION 3 - PHYSICS

Q51. A bullet of mass m is fired horizontally with a velocity v into a large stationary wooden block of mass M suspended by a long cord. The bullet becomes embedded inside the block. What physical quantity remains perfectly conserved throughout this specific collision process?

(a) Total kinetic energy alone

(b) Total linear momentum alone

(c) Both linear momentum and kinetic energy

(d) Neither linear momentum nor kinetic energy

Q52. What is the maximum value of static friction (limiting friction) acting between two dry solid surfaces in contact directly proportional to?

(a) The total apparent area of contact between the surfaces

(b) The magnitude of the normal reaction force acting perpendicular to the surfaces

(c) The instantaneous velocity of the sliding object

(d) The duration of time the surfaces have remained in contact

Q53. If the absolute distance separating two point masses is halved, what happens to the gravitational force of attraction acting between them according to Newton's Law of Universal Gravitation?

(a) It is reduced to half

(b) It is doubled

(c) It increases by four times

(d) It is reduced to one-fourth

Q54. According to Bernoulli's Principle, for the steady, streamline flow of an ideal, non-viscous fluid, an increase in the local velocity of the fluid occurs simultaneously with—

(a) A decrease in its static pressure

(b) An increase in its total density

(c) An increase in its temperature

(d) A decrease in its total mechanical energy

Q55. A particle executes simple harmonic motion (SHM) with an amplitude A. At what displacement x from its central equilibrium position does its potential energy become exactly equal to its kinetic energy?

(a) $x = \pm\frac{A}{2}$

(b) $x = \pm\frac{A}{\sqrt{2}}$

(c) $x = \pm\frac{A}{4}$

(d) $x = \pm\frac{\sqrt{3}A}{2}$

Q56. Which law of thermodynamics establishes the foundational scientific definition of temperature and forms the direct physical basis for constructing thermometers?

(a) First Law of Thermodynamics
(b) Second Law of Thermodynamics
(c) Third Law of Thermodynamics
(d) Zeroth Law of Thermodynamics

Q57. The total thermal energy radiated per unit area per second by a blackbody is directly proportional to the fourth power of its absolute temperature. This fundamental observation is known as—

(a) Wien's Displacement Law
(b) Stefan-Boltzmann Law
(c) Newton's Law of Cooling
(d) Kirchhoff's Law of Radiation

Q58. An electric dipole consisting of two equal and opposite charges separated by a small distance is placed inside a uniform, external electric field. What net mechanical effects does the dipole experience?

(a) It experiences a net translational force but zero torque
(b) It experiences a net torque but zero net translational force
(c) It experiences both a net translational force and a torque
(d) It experiences neither force nor torque

Q59. If a long, cylindrical copper wire has its absolute cross-sectional radius halved while its total length is kept completely constant, what happens to its electrical resistivity (ρ)?

(a) It increases by four times
(b) It increases by sixteen times
(c) It remains completely unchanged
(d) It is reduced to half

Q60. Five identical resistors, each of resistance $R = 10\ \Omega$, are arranged to form a classic, balanced Wheatstone bridge network. What is the equivalent resistance measured across the main terminals of this circuit?

(a) $2\ \Omega$
(b) $10\ \Omega$
(c) $50\ \Omega$
(d) $5\ \Omega$

Q61. A long, tightly wound solenoid carries a constant direct current I. What is the nature and distribution of the magnetic field generated deep inside the central core of the solenoid?

(a) Zero everywhere
(b) Highly non-uniform and decreasing toward the center
(c) Completely uniform and directed parallel to the solenoid axis
(d) Circularly structured around individual wire loops

Q62. The structural phenomenon where certain materials experience a complete, sudden drop in electrical resistance to absolute zero when cooled below a highly specific critical threshold temperature is known as—

(a) Thermoelectricity
(b) Superconductivity
(c) Piezoelectricity
(d) Ferromagnetism

Q63. An electromagnetic wave propagates through a vacuum along the positive x-axis. If the instantaneous electric field vector ($\vec{E}$) oscillates perfectly parallel to the y-axis, along which path does the corresponding magnetic field vector ($\vec{B}$) oscillate?

(a) Along the positive x-axis
(b) Along the z-axis
(c) Along the negative y-axis
(d) It does not oscillate at all

Q64. What type of optical lens is standardly prescribed by optometrists to correct the vision defect known as Myopia (nearsightedness)?

(a) Converging cylindrical lens
(b) Diverging concave lens
(c) Converging convex lens
(d) Bifocal geometric lens

Q65. In a standard single-slit diffraction experiment, what happens to the angular width of the central bright fringe maximum if the structural width of the slit is made narrower?

(a) It becomes narrower
(b) It becomes wider
(c) It remains completely unchanged
(d) It disappears entirely

Q66. The work function (ϕ_0) of a metal surface defines the absolute minimum energy required to—

(a) Transfer an electron from the inner shells to the conduction band

(b) Free a conduction electron from the surface of the metal into the surrounding vacuum

(c) Fuse two adjacent metal atoms together

(d) Stop the motion of incoming high-energy photons

Q67. According to Louis de Broglie's hypothesis of matter waves, what happens to the wavelength associated with an electron if its kinetic energy is increased by four times?

(a) It is doubled

(b) It is halved

(c) It increases by four times

(d) It is reduced to one-fourth

Q68. In the structural framework of the Bohr model of the hydrogen atom, what is the exact mathematical relationship governing the total energy (E_n) of an electron residing in its n-th stable orbit?

(a) $E_n \propto n$

(b) $E_n \propto n^2$

(c) $E_n \propto \frac{1}{n^2}$

(d) $E_n \propto \frac{1}{n}$

Q69. What specific nuclear force holds protons and neutrons securely bound together inside an atomic nucleus despite the intense electrostatic repulsion acting between the protons?

(a) Gravitational force

(b) Electromagnetic force

(c) Strong nuclear force

(d) Weak nuclear force

Q70. An ideal, intrinsic semiconductor material at absolute zero temperature ($0\ K$) acts as a perfect—

(a) Superconductor

(b) Electrical conductor

(c) Electrical insulator

(d) Rectifier diode

Q71. What properties define the ideal characteristics of a fuse wire used as a safety device in domestic electrical circuits?

(a) High electrical resistivity and high melting point

(b) Low electrical resistivity and low melting point

(c) High electrical resistivity and low melting point

(d) Low electrical resistivity and high melting point

Q72. An object is moving along a straight line with a constant acceleration. Which of the following graphs represents a straight line with a positive slope?

(a) Displacement-time graph

(b) Velocity-time graph

(c) Acceleration-time graph

(d) Force-displacement graph

Q73. The dimensions of the physical quantity known as "Planck's Constant" (h) are identical to the dimensions of—

(a) Linear momentum

(b) Angular momentum

(c) Mechanical work

(d) Power

Q74. What primary mechanism explains why a large sheet of thick iron plate sinks rapidly in a body of water, while a massive cruise ship constructed from thousands of tons of the same iron floats seamlessly?

(a) The ship experiences a lower gravitational pull due to its shape

(b) The hollow, spatial design of the ship encloses a massive volume of air, drastically reducing its average total density compared to water

(c) Surface tension forces support the wide base of the ship

(d) Viscosity forces hold the ship steady

Q75. Which fundamental conservation law forms the direct theoretical basis for deriving Kirchhoff's Second Law (the Loop Rule) in electrical circuit analysis?

(a) Conservation of electric charge

(b) Conservation of linear momentum

(c) Conservation of mechanical energy

(d) Conservation of total mass

SECTION 4 - ENGLISH

Q76. Identify the specific segment of the sentence that contains a grammatical error: "The complex statistical data / compiled by the epidemiological team / are indicating a downward trend / in vector-borne transmissions."

(a) The complex statistical data

(b) compiled by the epidemiological team

(c) are indicating a downward trend

(d) in vector-borne transmissions.

Q77. Choose the option that provides the most accurate grammatical improvement for the underlined segment: Scarcely had the critical care nurse adjusted the oxygen flow valve than the backup power system triggered a localized alarm.

(a) than the backup power system triggered

(b) when the backup power system triggered

(c) then the backup power system had triggered

(d) while the backup power system was triggering

Q78. Select the most appropriate meaning for the highlighted idiomatic expression: The young surgical resident decided to leave no stone unturned while reviewing the patient's extensive historical medical charts to locate the root cause of the rare pathology.

(a) To complete an administrative task with minimal physical effort.

(b) To use every possible course of action or resource available to achieve a goal.

(c) To accidentally cause a procedural delay due to hyper-fixation.

(d) To request a second diagnostic opinion from a senior consulting colleague.

Q79. Identify the specific segment of the sentence that contains a grammatical error: "The senior research fellow, along with his three laboratory assistants, / were awarded a prestigious federal grant / for their pioneering study / on cellular regeneration."

(a) The senior research fellow, along with his three laboratory assistants,

(b) were awarded a prestigious federal grant

(c) for their pioneering study

(d) on cellular regeneration.

Q80. Choose the word that is closest in meaning (SYNONYM) to the underlined word: The toxicologist provided an unequivocal statement confirming that the water supply samples contained zero trace quantities of heavy metals.

(a) Ambiguous

(b) Leaving no doubt; perfectly clear

(c) Hesitant

(d) Paradoxical

Q81. Choose the option that provides the most accurate grammatical improvement for the underlined segment: The clinical protocol requires that the technician sterilizes the instruments, verifies the calibration, and the patient's data must be recorded before any incisions begin.

(a) the patient's data must be recorded

(b) recording the patient's data accurately

(c) records the patient's operational data

(d) must record the patient's data manually

Q82. Choose the word that is most opposite in meaning (ANTONYM) to the given word: ALACRITY

(a) Eagerness

(b) Liveliness

(c) Lethargy

(d) Promptness

Q83. Identify the specific segment of the sentence that contains a grammatical error: "The patient was diagnosed with a rare chronic condition / and was explicitly advised / to abstain from / consuming highly processed sugars."

(a) The patient was diagnosed with a rare chronic condition

(b) and was explicitly advised

(c) to abstain from

(d) consuming highly processed sugars.

Q84. Select the option that displays the correct spelling of the word meaning "the structural state of being completely free from living bacteria, viruses, or other microorganisms":

(a) Sterility

(b) Sterillity

(c) Stereality

(d) Sterality

Q85. Choose the correct passive voice conversion for the given active sentence: "The laboratory technician is carefully analyzing the diagnostic tissue cultures under a high-resolution electron microscope."

(a) The diagnostic tissue cultures were carefully analyzed by the laboratory technician under a high-resolution electron microscope.

(b) The diagnostic tissue cultures are being carefully analyzed by the laboratory technician under a high-resolution electron microscope.

(c) The diagnostic tissue cultures have been carefully analyzed by the laboratory technician under a high-resolution electron microscope.

(d) Under a high-resolution electron microscope, the diagnostic tissue cultures carefully analyzed the laboratory technician.

SECTION 5 - GENERAL KNOWLEDGE

Q86. The specialized clinical diagnostic procedure historically known as the "Mantoux Test" is standardly performed in public health facilities to screen for exposure to which pathogen?

(a) *Vibrio cholerae*
(b) *Mycobacterium tuberculosis*
(c) *Salmonella typhi*
(d) *Corynebacterium diphtheriae*

Q87. Under the provisions of the Constitution of India, the concept of a "Welfare State" is explicitly outlined and enshrined within which specific segment?

(a) Part III: Fundamental Rights
(b) Part IV: Directive Principles of State Policy
(c) The Preamble
(d) Part IV(A): Fundamental Duties

Q88. The primary administrative headquarters of the "International Atomic Energy Agency" (IAEA), which works globally to promote the safe and peaceful use of nuclear technologies, is located in which city?

(a) Geneva, Switzerland
(b) New York, USA
(c) Vienna, Austria
(d) Paris, France

Q89. The famous "Gir National Park", widely recognized as the exclusive natural habitat of the wild Asiatic lion population, is located in which western Indian state?

(a) Rajasthan
(b) Maharashtra
(c) Madhya Pradesh
(d) Gujarat

Q90. In the Indian legislative system, a "Money Bill" can be officially introduced and initiated exclusively in which house of Parliament?

(a) Rajya Sabha (Council of States)
(b) Lok Sabha (House of the People)
(c) A Joint Session of both Houses
(d) The Supreme Court Collegium

Q91. Which prominent Indian scientific statutory body is responsible for monitoring space-based atmospheric data and issuing official meteorological forecasts nationwide?

(a) Indian Space Research Organisation (ISRO)

(b) India Meteorological Department (IMD)

(c) Council of Scientific and Industrial Research (CSIR)

(d) Defence Research and Development Organisation (DRDO)

Q92. The vast geographic region known as the "Rift Valley" system is an immense geological feature characterized by tectonic divergence running primarily through which continent?

(a) South America

(b) Asia

(c) Africa

(d) Australia

Q93. Which prominent social reformer and nationalist leader founded the "Servants of India Society" in 1905 to unite and train Indians for civic humanitarian work?

(a) Gopal Krishna Gokhale

(b) Bal Gangadhar Tilak

(c) Mahatma Gandhi

(d) Jyotirao Phule

Q94. The "International Court of Justice" (ICJ), functioning as the principal judicial organ of the United Nations, holds its permanent seat in which global city?

(a) Geneva, Switzerland

(b) The Hague, Netherlands

(c) New York, USA

(d) Rome, Italy

Q95. Who functions as the ex-officio Chairman of the Rajya Sabha (the upper house of the Parliament of India) under the constitutional framework?

(a) The Speaker of the Lok Sabha

(b) The Prime Minister of India

(c) The Vice-President of India

(d) The Chief Justice of India

Q96. The ambitious national health insurance program launched by the Government of India to offer comprehensive secondary and tertiary care hospitalization coverage to low-income families is titled—

(a) Pradhan Mantri Suraksha Bima Yojana

(b) Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (PM-JAY)

(c) Rashtriya Swasthya Bima Yojana

(d) Aam Aadmi Bima Yojana

Q97. Which standard imaginary line of geographic calculation divides the Earth perfectly into Eastern and Western Hemispheres, running through Greenwich, England?

(a) The Equator
(b) The Prime Meridian
(c) The International Date Line
(d) The Tropic of Cancer

Q98. The administrative body known as the "National AIDS Control Organisation" (NACO), which spearheads structural prevention programs and research across India, functions directly under which Union Ministry?

(a) Ministry of Social Justice and Empowerment
(b) Ministry of Women and Child Development
(c) Ministry of Health and Family Welfare
(d) Ministry of Science and Technology

Q99. In the annals of medical milestones, who successfully isolated and discovered the specific bacterial causative agent of Tuberculosis (*Mycobacterium tuberculosis*) in the year 1882?

(a) Louis Pasteur
(b) Robert Koch
(c) Alexander Fleming
(d) Joseph Lister

Q100. The geographic landmass known as the "Majuli Island", documented as the world's largest freshwater river island, is formed within the course of which river system?

(a) Ganga River
(b) Brahmaputra River
(c) Indus River
(d) Godavari River

SOLUTIONS

Q1. Correct Answer: (B)

During photosynthesis, electrons move from water through PSII and PSI before reducing $NADP^+$. This electron transport chain helps generate ATP and NADPH.

Q2. Correct Answer: (B)

A high cytokinin to auxin ratio promotes shoot formation in plant tissue culture. Auxins generally favor root development.

Q3. Correct Answer: (B)

Cortical granules harden the zona pellucida after sperm entry. This prevents entry of additional sperms and avoids polyspermy.

Q4. Correct Answer: (A)

A child with blood group O must receive recessive alleles from both parents. An AB father cannot provide an I^o allele.

Q5. Correct Answer: (B)

Aminoacyl-tRNA synthetase attaches the correct amino acid to its specific tRNA. This step ensures accuracy during protein synthesis.

Q6. Correct Answer: (B)

Chromosome doubling within the same population causes reproductive isolation instantly. This process is known as sympatric speciation.

Q7. Correct Answer: (B)

The slit diaphragm between podocyte pedicels blocks large plasma proteins. Its negative charge repels protein molecules.

Q8. Correct Answer: (B)

C_4 plants initially fix carbon dioxide using PEP carboxylase. This minimizes photorespiration under hot conditions.

Q9. Correct Answer: (B)

Voltage-gated sodium channels become inactivated during the refractory period. No second action potential can start immediately.

Q10. Correct Answer: (D)

Biomagnification increases toxin concentration at higher trophic levels. Top predators accumulate the maximum toxin load.

Q11. Correct Answer: (B)

The first heart sound occurs due to closure of AV valves. It marks the beginning of ventricular systole.

Q12. Correct Answer: (C)

Natural Killer cells destroy infected and cancerous cells directly. They are important components of innate immunity.

Q13. Correct Answer: (B)

One centimorgan corresponds to 1% recombination frequency. It is used in genetic linkage mapping.

Q14. Correct Answer: (A)

Epinephrine activates the cAMP pathway through G-protein coupled receptors. Protein Kinase A then mediates cellular responses.

Q15. Correct Answer: (C)

Monera includes prokaryotic organisms lacking a membrane-bound nucleus. This distinguishes them from all other kingdoms.

Q16. Correct Answer: (A)

Urine flows from renal pelvis to ureter, then bladder and urethra. This is the normal urinary pathway.

Q17. Correct Answer: (C)

The Lac repressor binds to the operator region of the operon. This blocks RNA polymerase movement.

Q18. Correct Answer: (C)

Vascular rays conduct water and nutrients radially in woody stems. They also help in storage.

Q19. Correct Answer: (B)

Convergent evolution produces similar traits in unrelated organisms. Environmental pressures drive these adaptations.

Q20. Correct Answer: (B)

Hydrogen bonds stabilize the alpha-helix structure of proteins. They form between backbone carbonyl and amino groups.

Q21. Correct Answer: (C)

Tight junctions prevent leakage between adjacent epithelial cells. They maintain selective barriers in tissues.

Q22. Correct Answer: (A)

Allen's Rule states that animals in cold climates develop shorter appendages. This reduces heat loss from the body.

Q23. Correct Answer: (B)

Primary oocytes remain arrested in Prophase I until puberty. Specifically, arrest occurs at the diplotene stage.

Q24. Correct Answer: (C)

DNA primase synthesizes short RNA primers during replication. DNA polymerase then extends the strand.

Q25. Correct Answer: (C)

Vital Capacity equals TV + IRV + ERV. It represents the maximum air expelled after deep inspiration.

Q26. Correct Answer: (A)

Real gases deviate most from ideal behavior at low temperature and high pressure. Intermolecular forces and molecular volume become significant under these conditions.

Q27. Correct Answer: (D)

H_2S has two bonding pairs and two lone pairs on sulfur. This gives it a bent molecular geometry.

Q28. Correct Answer: (B)

Nitrogen has higher ionization enthalpy than oxygen due to half-filled stability. Fluorine has the highest value among these elements.

Q29. Correct Answer: (C)

A catalyst changes only the rate of reaction, not equilibrium constant. Both forward and backward reactions accelerate equally.

Q30. Correct Answer: (C)

Mn^{2+} has electronic configuration $[Ar]\,3d^5$. All five d-electrons remain unpaired.

Q31. Correct Answer: (C)

De Broglie wavelength is inversely proportional to momentum. Since electrons have much smaller mass, they possess longer wavelengths.

Q32. Correct Answer: (B)

Schottky defect involves equal loss of cations and anions from lattice sites. This lowers crystal density without affecting stoichiometry.

Q33. Correct Answer: (B)

$\Delta T_f = K_f \times m$ gives $0.372 = 1.86 \times m$. Hence molality $m = 0.2$.

Q34. Correct Answer: (C)

Carbon monoxide reduces iron oxides to iron in the blast furnace. It acts as the principal reducing agent.

Q35. Correct Answer: (A)

Wilkinson's catalyst is $[Rh(PPh_3)_3Cl]$. It is widely used for homogeneous hydrogenation.

Q36. Correct Answer: (C)

NF_3 possesses a pyramidal structure with net dipole moment. The dipoles do not cancel completely.

Q37. Correct Answer: (B)

Phenol on heating with zinc dust loses oxygen to form benzene. This reaction is a reduction process.

Q38. Correct Answer: (A)

The relation is $\Delta G^\circ = -nFE^\circ_{cell}$. Negative Gibbs energy indicates spontaneity.

Q39. Correct Answer: (C)

Tertiary carbocations are most stable due to hyperconjugation and inductive effects. More alkyl groups stabilize the positive charge.

Q40. Correct Answer: (B)

Aqueous alkali replaces halogen with hydroxyl group. This is a nucleophilic substitution reaction.

Q41. Correct Answer: (B)

Tollens' reagent is ammoniacal silver nitrate solution. It gives silver mirror test with aldehydes.

Q42. Correct Answer: (B)

Nylon-6,6 forms through condensation polymerization. Water molecules are eliminated during polymer formation.

Q43. Correct Answer: (B)

PCC oxidizes primary alcohols into aldehydes without further oxidation. Thus propan-1-ol forms propanal.

Q44. Correct Answer: (A)

The aldehyde carbon gets priority numbering in IUPAC nomenclature. Hence the compound is 3-hydroxybutanal.

Q45. Correct Answer: (C)

Uracil occurs only in RNA and replaces thymine found in DNA. It is a pyrimidine nitrogen base.

Q46. Correct Answer: (C)

Overall order equals the sum of powers in the rate equation. Thus overall order $= 1+2 = 3$.

Q47. Correct Answer: (B)

Hypophosphoric acid $H_4P_2O_6$ contains a direct P–P bond. Other listed acids do not contain this linkage.

Q48. Correct Answer: (B)

Primary aliphatic amines form unstable diazonium salts with nitrous acid. These decompose to alcohols with nitrogen gas evolution.

Q49. Correct Answer: (C)

According to Hardy-Schulze rule, higher charge ions coagulate colloids more effectively. $[Fe(CN)_6]^{4-}$ has maximum flocculating power here.

Q50. Correct Answer: (B)

CrO_2 behaves as a metallic conductor and shows ferromagnetism. It is used in magnetic recording materials.

Q51. Correct Answer: (B)

In an inelastic collision, total linear momentum remains conserved. Kinetic energy is not conserved because some energy converts into heat and sound.

Q52. Correct Answer: (B)

Limiting friction is directly proportional to the normal reaction force. It is given by $F = \mu N$.

Q53. Correct Answer: (C)

Gravitational force varies inversely with the square of distance. Halving the distance increases the force four times.

Q54. Correct Answer: (A)

According to Bernoulli's principle, higher fluid velocity corresponds to lower pressure. Mechanical energy remains conserved in ideal fluid flow.

Q55. Correct Answer: (B)

In SHM, kinetic energy equals potential energy at $x = \frac{A}{\sqrt{2}}$. At this position, each energy equals half of total energy.

Q56. Correct Answer: (D)

The Zeroth Law establishes the concept of thermal equilibrium. It forms the basis for temperature measurement.

Q57. Correct Answer: (B)

Stefan-Boltzmann Law states that radiation emitted is proportional to T^4. Hotter bodies radiate energy much faster.

Q58. Correct Answer: (B)

A dipole in uniform electric field experiences torque only. Net translational force becomes zero.

Q59. Correct Answer: (C)

Electrical resistivity depends only on material and temperature. Changing dimensions does not affect resistivity.

Q60. Correct Answer: (B)

In a balanced Wheatstone bridge, the middle resistor carries no current. Equivalent resistance becomes $10\ \Omega$.

Q61. Correct Answer: (C)

Magnetic field inside a long solenoid is nearly uniform and parallel to its axis. It behaves like a bar magnet internally.

Q62. Correct Answer: (B)

Superconductivity is the phenomenon of zero electrical resistance below critical temperature. Current can flow without energy loss.

Q63. Correct Answer: (B)

Electric field, magnetic field, and wave propagation are mutually perpendicular. Hence magnetic field oscillates along the z-axis.

Q64. Correct Answer: (B)

Myopia is corrected using a concave lens. It diverges incoming light rays before they reach the eye lens.

Q65. Correct Answer: (B)

Narrowing the slit increases diffraction spreading. Thus the central bright fringe becomes wider.

Q66. Correct Answer: (B)

Work function is the minimum energy needed to remove an electron from metal surface. It is important in photoelectric effect.

Q67. Correct Answer: (B)

De Broglie wavelength is inversely proportional to square root of kinetic energy. Increasing kinetic energy four times halves the wavelength.

Q68. Correct Answer: (C)

In Bohr's model, total energy varies as $\frac{1}{n^2}$. Higher orbits possess less negative energy.

Q69. Correct Answer: (C)

Strong nuclear force binds nucleons together inside the nucleus. It overcomes electrostatic repulsion between protons.

Q70. Correct Answer: (C)

At absolute zero, intrinsic semiconductors have no free charge carriers. Hence they behave like perfect insulators.

Q71. Correct Answer: (C)

Fuse wires require high resistivity and low melting point. They melt quickly when excessive current flows.

Q72. Correct Answer: (B)

Velocity-time graph of uniformly accelerated motion is a straight line. Its slope represents acceleration.

Q73. Correct Answer: (B)

Planck's constant has dimensions of angular momentum. Its dimensional formula is $[ML^2T^{-1}]$.

Q74. Correct Answer: (B)

A ship floats because its average density becomes less than water. The enclosed air greatly increases displaced water volume.

Q75. Correct Answer: (C)

Kirchhoff's Loop Rule is based on conservation of energy. Total potential difference around a closed loop equals zero.

Q76. Correct Answer: (C)

The subject "data" is treated as singular in modern usage here. Hence "are indicating" should be replaced with "is indicating".

Q77. Correct Answer: (B)

The structure "Scarcely... when" is grammatically correct. "Than" is incorrect in this expression.

Q78. Correct Answer: (B)

"To leave no stone unturned" means making every possible effort. It implies thorough and determined action.

Q79. Correct Answer: (B)

The subject "The senior research fellow" is singular. Therefore "were awarded" should be replaced with "was awarded".

Q80. Correct Answer: (B)

"Unequivocal" means absolutely clear and leaving no doubt. It refers to certainty and clarity.

Q81. Correct Answer: (A)

Parallel structure is needed throughout the sentence. "Must be recorded" breaks the grammatical consistency.

Q82. Correct Answer: (C)

"Alacrity" means eagerness or quickness. Its opposite meaning is "lethargy".

Q83. Correct Answer: (D)

The sentence is grammatically correct in all parts. No error exists in the sentence.

Q84. Correct Answer: (A)

"Sterility" is the correct spelling of the word. It means complete absence of microorganisms.

Q85. Correct Answer: (B)

The active sentence is in present continuous tense. Hence the passive form becomes "are being analyzed".

Q86. Correct Answer: (B)

The Mantoux Test is used to detect exposure to *Mycobacterium tuberculosis*. It helps screen individuals for tuberculosis infection.

Q87. Correct Answer: (B)

Directive Principles of State Policy describe the idea of a Welfare State. They guide the government in policy making.

Q88. Correct Answer: (C)

The International Atomic Energy Agency (IAEA) is headquartered in Vienna, Austria. It promotes peaceful use of nuclear energy.

Q89. Correct Answer: (D)

Gir National Park in Gujarat is the natural habitat of Asiatic lions. It is the only wild population of Asiatic lions in the world.

Q90. Correct Answer: (B)

A Money Bill can only originate in the Lok Sabha. The Rajya Sabha has limited powers regarding it.

Q91. Correct Answer: (B)

India Meteorological Department (IMD) issues weather forecasts nationwide. It monitors climate and atmospheric conditions.

Q92. Correct Answer: (C)

The Great Rift Valley system mainly extends through Africa. It was formed due to tectonic plate divergence.

Q93. Correct Answer: (A)

Gopal Krishna Gokhale founded the Servants of India Society in 1905. The organization promoted social service and nationalism.

Q94. Correct Answer: (B)

The International Court of Justice is located in The Hague, Netherlands. It is the principal judicial organ of the United Nations.

Q95. Correct Answer: (C)

The Vice-President of India serves as the ex-officio Chairman of Rajya Sabha. He presides over its proceedings.

Q96. Correct Answer: (B)

Ayushman Bharat PM-JAY provides health insurance coverage to poor families. It supports secondary and tertiary healthcare services.

Q97. Correct Answer: (B)

The Prime Meridian divides Earth into Eastern and Western Hemispheres. It passes through Greenwich, England.

Q98. Correct Answer: (C)

NACO functions under the Ministry of Health and Family Welfare. It coordinates AIDS prevention and control programs.

Q99. Correct Answer: (B)

Robert Koch discovered the bacterium causing tuberculosis in 1882. His work revolutionized medical microbiology.

Q100. Correct Answer: (B)

Majuli Island is formed in the Brahmaputra River system. It is recognized as the world's largest freshwater river island.