# PAPER : IIT-JAM 2010
## BIOTECHNOLOGY-BT

INSTRUCTIONS:

(*i*)   This test paper has a total of 100 questions.

(*ii*)   Each question has **4 choices** for its answer : (a), (b), (c) and (d). Only **one** of them is the correct answer.

(*iii*) For each correct answer, you will be awarded **3 (three)** marks.

(*iv*)   For each wrong answer, you will be awarded **–1 (Negative one)** mark.

(*v*)   Multiple answers to a question will be treated as a wrong answer.

(*vi*)   For each un-attempted question, you will be awarded **0 (zero)** mark.

1.   The composition of proteins P1 to P4 are shown below:

Protein	Composition
P1	Rich in polar residues; poor in apolar residues
P2	Rich in apolar residues; poor in polar residues
P3	Has comparable number of polar and apolar residues
P4	Rich in glycine and proline

Which one of the following options CORRECTLY relates the propensities of these proteins to be folded, aggregated or disordered in an aqueous buffered solution?

(a) P1, P2 and P4 are disordered and P3 is folded

(b) P1 and P3 are folded, P2 is aggregated and P4 is disordered

(c) P1 and P3 are folded, and P2 and P4 are disordered

(d) P1 and P4 are disordered, P2 aggregated and P3 is folded

2.   EnzP, EnzQ, EnzR, and EnzS catalyze the metabolic reactions as shown below:
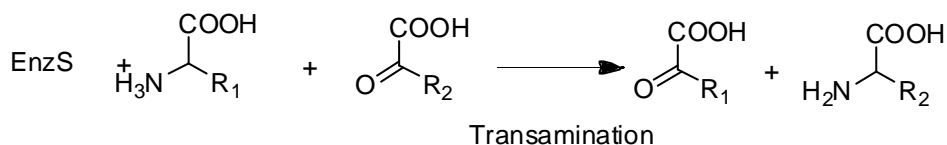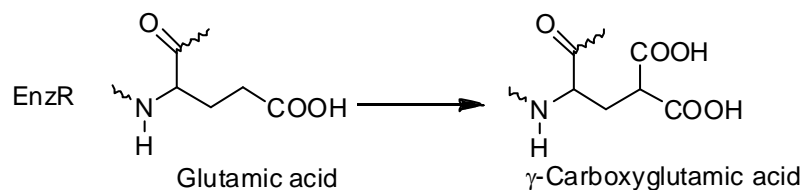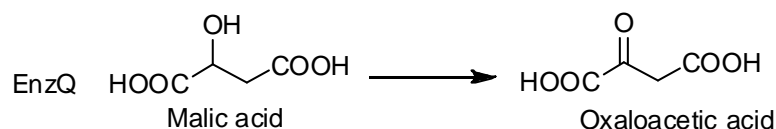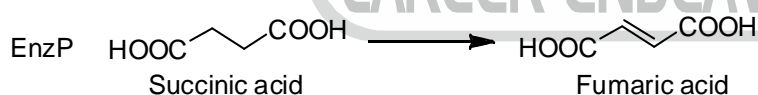
Each of the above enzymes is dependent on one of the following four vitamins (either the vitamin itself or its derivative):

Vit B2: Vitamin B2 (riboflavin)
Vit B3: Vitamin B3 (niacin)
Vit B6: Vitamin B6 (pyridoxal)
Vit K: Vitamin K

Which one of the following options gives the *correct* enzyme-vitamin matches?
(a) EnzP and Vit B3, EnzQ and Vit B2, EnzR and Vit B6, EnzS and Vit K
(b) EnzP and Vit B2, EnzQ and Vit B3, EnzR and Vit B6, EnzS and Vit K
(c) EnzP and Vit B2, EnzQ and Vit B3, EnzR and Vit K, EnzS and Vit B6
(d) EnzP and Vit B6, EnzQ and Vit B2, EnzR and Vit B3, EnzS and Vit K

3. The ground state energy of hydrogen atom is –13.6 eV. Assume hc = 1240 eV. nm. The maximum wavelength in Balmer series (in nm) is approximately
(a) 103 (b) 122 (c) 244 (d) 653

4. A sample of gas $\left(\dfrac{C_P}{C_V} = 1.5 \right)$, at a higher pressure P and temperature T, is suddenly released to atmosphere. The final temperature of the gas is T/2. The value of P (in the units of atm) is
(a) 4 (b) $4\sqrt{2}$ (c) 8 (d) $8\sqrt{2}$

5. A ball is thrown with a speed of 40 m/sec in a direction of 30º with the ground. Assume g = 10m/sec^2. The ball will reach to a maximum height (in meters) of
(a) 20 (b) 40 (c) 60 (d) 80

6. The dimensions $ML^2 T^{-2}$ *do not* correspond to
(a) work (b) torque (c) heat (d) angular momentum

7. $\lim\limits_{n\to\infty}\left[\dfrac{1}{n} + \dfrac{n^2}{(n+1)^3} + \dfrac{n^2}{(n+2)^3} + ... + \dfrac{1}{8n} \right]$ is
(a) 1/8 (b) 1/4 (c) 3/8 (d) 1/2

8. The area (in square units of length) enclosed by $y = 2x^2 + 1$ and $6x - y = 3$ is
(a) 1/3 (b) 2/3 (c) 1 (d) 4/3

9. Suppose the principal increases continuously at the rate of r% per year. If Rs. 100 doubles in 10 years, then r is
(a) $5 \log_e 2$ (b) $10 \log_e 2$ (c) $50 \log_e 2$ (d) $100 \log_e 2$

10. A eukaryotic cell lacking active telomerase
(a) will be unable to proofread incorrectly-added nucleotides
(b) is highly probable to be a cancerous cell
(c) will experience a gradual reduction of chromosome length with each, replication cycle
(d) will be unable to connect Okazaki fragments

11. Which of the following are used as reporter genes?

P. β-glucuronidase gene   Q. ampicillin-resistance gene

R. Gal4 gene   S. luciferase gene

(a) P and S   (b) P and Q

(c) R and S   (d) Q and R

12. *p*-aminobenzoic acid is a biosynthetic precursor of
    (a) glutamic acid
    (b) acetic acid
    (c) citric acid
    (d) folic acid

13. Ribosomes are made of
    (a) DNA and proteins
    (b) RNA and proteins
    (c) only proteins
    (d) DNA, RNA and proteins

14. The anticodon in tRNA is
    (a) complementary to codon in rRNA
    (b) complementary to codon in mRNA
    (c) complementary to $3'-$ end of tRNA where amino acid binds
    (d) changeable depending upon the amino acid it binds to

15. Which one of the following hormones shows photoperiodicity?
    (a) thyroxine
    (b) melatonin
    (c) cortisol
    (d) relaxin

16. Which of the following ligament(s) is/are attached to ovary?
    P. ovarian ligaments
    Q. suspensory ligaments
    R. broad ligaments
    (a) only P
    (b) only P and Q
    (c) only P and R
    (d) P, Q and R

17. The role of salicylic acid in systemic acquired resistance of plants is to
    (a) directly destroy the pathogens
    (b) activate defenses throughout the plant before the infection spreads
    (c) activate heat shock proteins
    (d) sacrifice the infected tissue

18. Match the therapeutics in Column-I with their applications in Column-II

Column-I	Column-II
P. Erythropoietin	1. Diabetes
Q. Plasminogen activator	2. Obesity
R. Leptin	3. Anemia
S. Cathepsin K	4. Myocardial infarction
T. Humulin	5. Osteoporosis
	6. Cancer therapy

    (a) P-3, Q-6, R-2, S-4, T-1
    (b) P-5, Q-4, R-6, S-3, T-2
    (c) P-3, Q-4, R-2, S-5, T-1
    (d) P-5, Q-6, R-4, S-3, T-1

19. The 2009 Nobel prizes were awarded to work on
    (a) human papilloma virus and ribosome virus
    (b) *Helicobacter pylori* and human papilloma
    (c) ribosome and telomerase
    (d) telomerase and *Helicobacter pylori*

20. Which of the following statements about yeast are *correct*?
    P. Yeast are fungi
    Q. Yeast can form pseudohyphae
    R. Yeast reproduce asexually by budding
    S. Yeast are facultative anaerobes
    T. All yeast are pathogenic
    U. All yeast are dimorphic
    (a) P, Q, R and S
    (b) R, S, T and U
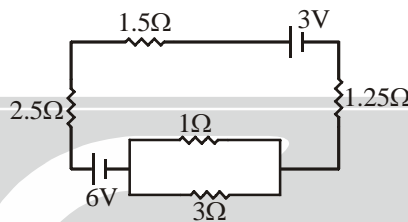   (c) P, R, S and U
    (d) Q, R, S and T

21. An L shaped wire PQR carrying a current i is placed at a distance s from the origin (see the figure below). The length PQ is l such the $l \gg s$. The magnitude of the magnetic field B at origin O is

    (a) $\dfrac{\mu_0 i}{\pi S}$ (b) $\dfrac{\mu_0 i}{2\pi S}$

    (c) $\dfrac{\mu_0 i}{4\pi S}$ (d) $\dfrac{\mu_0 i}{8\pi S}$
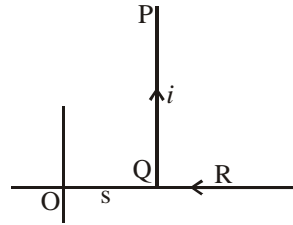
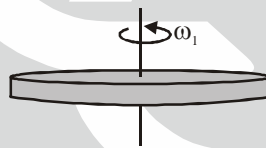22. The current (in A) in the given circuit, assuming the internal resistance of the batteries to be negligible, is

    (a) 1/4
    (b) 1/2
    (c) 3/4
   (d) 9/8

23. A gaseous mass M in the form of a thin disk of radius R is rotating with ω_1 as shown in the figure below.

    A fraction M/4 of the gas condenses into a thin ring of radius R and the remaining into a concentric disk of radius R/2. The system now rotates with ω_1 about the same axis. The ratio $\dfrac{\omega_1}{\omega_2}$ is

    (a) 16/7   (b) 16/11   (c) 7/8   (d) 4/5

24. The terminal speed (in m/s) of vertically falling raindrop of radius 0.03 cm ($g = 9.9$ m/s^2, $\eta_{air} = 1.8 \times 10^{-4}$ poise and $\rho_{power} = 1000$ kg/m^3) is approximately

    (a) 0.11   (b) 0.55   (c) 1.10   (d) 2.20

25. In an RC circuit, a resistor of resistance $120\,\Omega$ and a capacitor are connected to a 240 V, 50Hz ac source. The circuit takes a current of 1.2A. The reactance of the capacitor (in Ω) is

    (a) 80   (b) 120   (c) 160   (d) 240

26. A bob of mass m of a long pendulum of length L is at a horizontal position P (see figure below). When released, it hits a ball of mass m placed at a position Q. Assume the collision to be elastic. After hitting the ball at Q, the bob will attain a height (with respect to Q) of
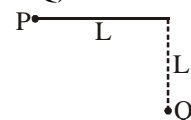
    (a) 0   (b) L/4

    (c) L/2   (d) L

27. Signal recognition particles (SRPs) are
    (a) protein-DNA complexes involved in protein sorting
    (b) protein-RNA complexes involved in protein sorting
    (c) protein-RNA complexes involved in RNA splicing
    (d) protein-RNA complexes involved in cell cycle

28. M Phase promoting factor (MPF) facilitates cells to move from G2 to M phase during the cell cycle. The sudden decline in MPF at the end of the M Phase is due to
    (a) degradation of CDKs
    (b) degradation of cyclins
    (c) the reduced expression of cyclins
    (d) an increase in the ratio of cell volume and genome

29. Which of the following statements are *true* regarding the dolichol phosphate pathway?
    P. a 14-residue precursor oligosacchadride chain is synthesized in the ER
    Q. a 14-residue precursor oligosacchadride chain is synthesized in the Golgi complex
    R. it helps in *N*-linked glycosylation of proteins
    S. it helps in *O*-linked glycosylation of proteins
    (a) P and R   (b) Q and R   (c) Q and S   (d) P and S

30. Which one of the following is *not true* about Klenow, fragment?
    (a) It is a proteolytic cleavage product of DNA polymerase I
    (b) It has $5' \rightarrow 3'$ polymerase activity
    (c) It has $3' \rightarrow 5'$ exonuclease activity
    (d) It has $5' \rightarrow 3'$ exonuclease activity

31. In which one of the following options are the cellular compartments arranged in the increasing order of their pH?
    (a) Nucleus, mitochondrial matrix, trans-Golgi network, lysosome
    (b) Lysosome, nucleus, trans-Golgi network, mitochondrial matrix
    (c) Lysosome, trans-Golgi network, nucleus, mitochondrial matrix
    (d) Lysosome, nucleus, mitochondrial matrix, trans-Golgi network

32. Match the entries in Column-I with those in Column-II

| Column-I	Column-II
P. Photoautotrophs	1. Energy source : light Carbon source : CO_2
Q. Photoheterotrophs	2. Energy source : light Principal carbon source : an organic compound
R. Chemoautotrophs	3. Energy source : chemical molecule Principal carbon source: CO_2
S. Chemoheterotrophs	4. Energy source : chemical molecule Principal carbon source: an organic compound

    (a) P-1, Q-2, R-3, S-4   (b) P-3, Q-2, R-4, S-1
    (c) P-2, Q-4, R-1, S-3   (d) P-4, Q-3, R-2, S-1

33. Which one of the following is NOT a saturated fatty acid?
    (a) Palmitic acid   (b) Stearic acid
    (c) Oleic acid   (d) Myristic acid

34. The feeding relationship among the species in a community determine the community's
    (a) secondary succession   (b) ecological niche
    (c) Oleic acid   (d) Myristic acid

35. Which one of the following techniques can be used to find whether a given sample contains glucose or galactose?
    (a) Paper chromatography   (b) Thin layer chromatography
    (c) NMR spectroscopy   (d) UV spectroscopy

36. Match the entries in Column-I with those in Column-II.

Column-I	Column-II
P. Metachromatic granules	1. Phosphate storage
Q. Sulfur granules	2. Energy reserve
R. Magnetosomes	3. Decomposition of H_2O_2

    (a) P-1, Q-2, R-3   (b) P-2, Q-3, R-1
    (c) P-2, Q-1, R-3   (d) P-3, Q-2, R-1

37. Which of the following statements pertaining to 2D gel electrophoresis of proteins is / are CORRECT?
    P. While preparing the sample from a tissue, the sample should be dissolved in SDS
    Q. The duration for which the SDS gel is run should not vary to ensure reproducibility
    (a) Only P   (b) Only Q   (c) P and Q   (d) Neither P nor Q

38. An inductive coil of resistance 1Ω is connected to a 20V battery. Neglect the internal resistance of the battery. The value of the induced emf (in V) in the coil at an instant when the current has risen to one-fourth of its steady value is

    (a) 5   (b) $5\sqrt{2}$ (c) 10   (d) 15

39. A charge $+Q$ is uniformly distributed in a sphere of radius R. The magnitude of the electric field E at a distance $\dfrac{R}{2}$ from the centre of the sphere is

    (a) 0   (b) $\dfrac{Q}{32\pi\varepsilon_0 R^2}$ (c) $\dfrac{Q}{16\pi\varepsilon_0 R^2}$ (d) $\dfrac{Q}{8\pi\varepsilon_0 R^2}$

40. A vibrating string of length l has mass m. It vibrates with a fundamental frequency when stretched by a force of 1N. This string will vibrate with second harmonic (i.e., first overtone) if the force is increased to

    (a) $\dfrac{1}{2}$ N   (b) $\sqrt{2}$ N   (c) 4N   (d) 8N

41. Electrons are emitted in photoelectric effect, and beta particles are emitted in radioactive decay of nuclei. Which one of the following statements is CORRECT?
    (a) The energy of photoelectrons is much greater than that of beta particles
    (b) The energy of beta particles is much greater than that of photoelectrons
    (c) The energies of photoelectrons and beta particles are of same order
    (d) Beta particles and photoelectrons have different masses

42. Two sources of light are coherent if they emit radiation of
    (a) unequal intensities, same wavelength and same phase
    (b) equal intensity, same wavelength and different phases
    (c) unequal intensities, same wavelength and different phases
    (d) equal intensity, different wavelengths and different phases

43. Which one of the following schematics CORRECTLY depicts the variation of conductance as a function of membrane potential for the voltage-gated K^+-channel?
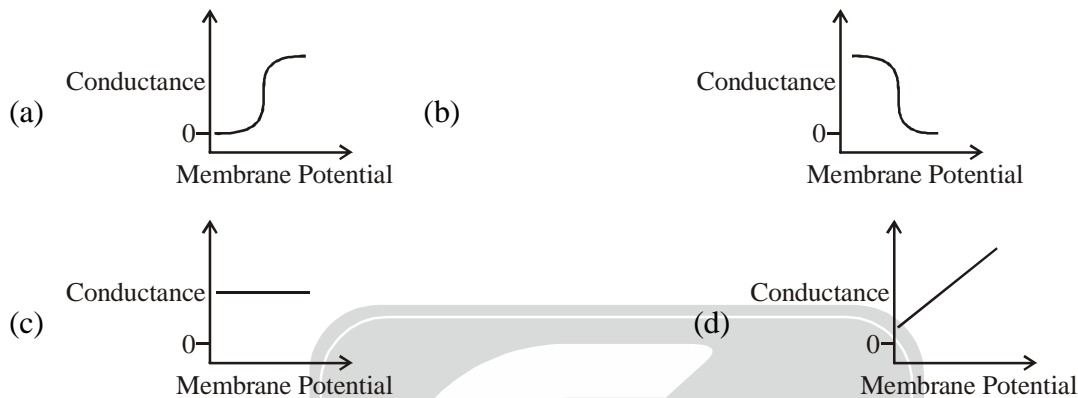

44. In a xenogenic cell based therapy, the donor and recipient belong to different species. In which of the following, do the donor and recipient belong to the same species?
    P. Autologous
    Q. Allogenic
    R. Syngeneic
    (a) Only P   (b) Only P and Q
    (c) Only P and R   (d) P, Q and R

45. According to the following schematic, which shows the effect of the ligand L on the allosteric protein P,


Low affinity for L   High affinity for L
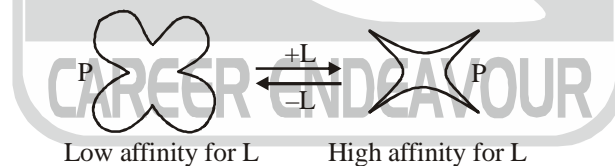
    (a) L has to be an allosteric activator
    (b) L has to be an allosteric inhibitor
    (c) L can be either an allosteric activator or an allosteric inhibitor
    (d) L is not an allosteric modulator of the protein

46. Which one(s) among helicase, primase, telomerase and topoisomerase can form phosphodiester bonds?
    (a) Only primase   (b) Primase and telomerase only
    (c) Primase, telomerase and topoisomerase only   (d) All the four enzymes

47. Type II hypersensitivity
    (a) is antibody independent
    (b) is complement independent
    (c) is mediated by $CD8^+T$ cells
    (d) involves antibody mediated destruction of cells

48. Which of the following statements relating to photosynthesis are CORRECT?

    P. Carotenoids protect against toxic oxygen species

    Q. When plants utilize blue light, they can harness more energy than when they utilize red light

    R. The porphyrin ring in both chlorophyll and bacteriopheophytin has magnesium

    S. Chemical modification of the porphyrin ring alters its absorption spectrum

    T. The Z-scheme, depicting the flow of electrons in photosynthesis, is based on oxidation potentials

    U. Carboxysomes are subcellular structures present in certain prokaryotes

    V. Efflux of magnesium from the thylakoid lumen into he stroma helps in the activation of RuBisCo

    (a) P, Q and R

    (b) Q, R, S and V

    (c) R, S, T and V

    (d) P, S, T, U and V

49. Which of the following membranes have a proton-pumping ATPases?

    BPM   Bacterial plasma membrane

    CIM   Chloroplast inner membrane

    TGM   Trans-Golgi membrane

    LM   Lysosomal membrane

    MIM   Mitochondrial inner membrane

    VM   Vacuolar membrane

    (a) BPM, CIM, MIM and VM

    (b) BPM, TGM, MIM and VM

    (c) CIM, LM, MIM and VM

    (d) BPM, LM, MIM and VM

50. Which one of the following statements is NOT CORRECT?

    (a) A mass m is enclosed in a spherical shell. The gravitational force on this mass due to another point mass M lying outside the shell is zero

    (b) When an object of mass m is in motion under a gravitational force, both angular momentum and total mechanical energy are conserved

    (c) The acceleration due to gravity decreases with increasing altitude

    (d) The acceleration due to gravity is dependent on the mass of earth

51. An electromagnetic wave with a magnetic field vector

    $\vec{B} = 100 \times 10^{-9}$ T cos $[(1.8 \text{ rad/m})y + (5.4 \times 10^6 \text{ rad/s})t]\hat{k}$

    propagates along

    (a) $+\hat{j}$ and its electric field vector is along $-\hat{i}$

    (b) $-\hat{j}$ and its electric field vector is along $+\hat{i}$

    (c) $+\hat{j}$ and its electric field vector is along $+\hat{i}$

    (d) $-\hat{j}$ and its electric field vector is along $-\hat{i}$

52. Which one of the following statement is NOT CORRECT?

    (a) In an unbiased p-n junction, the electric potential of n-side is higher than that of the p-side

    (b) When a p-n junction is forward biased, the width of the depletion region increases

    (c) When a p-n junction is forward biased, the forward current is due to both electron and hole diffusion

    (d) When a p-n junction is forward biased, the potential of the p-side increases

53. Which one of the following statements is **CORRECT** for the reaction
    $2HNO_3(aq) + Cu(s) + 2H^+(aq) \rightarrow 2NO_2(g) + Cu^{2+}(g) + 2H_2O(l)$?
    (a) H^+ is the oxidizing agent, and Cu is the reducing agent
    (b) H^+ is the oxidizing agent, and HNO_3 is the reducing agent
    (c) HNO_3 is the oxidizing agent, and Cu is the reducing agent
    (d) Cu is the oxidizing agent, and HNO_3 is the reducing agent

54. Which of the following Fischer projections of glyceraldehyde have identical absolute configuration?
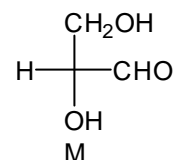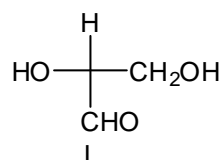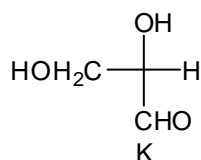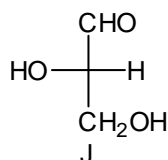

    (a) K, L and M   (b) J, K and M   (c) J, K and L   (d) J, L and M

55. In a water solution, the concentration of OH^- at 25°C is 10^{-5} mole/liter. The concentration of H_3O^+
    is
    (a) 10^{-19} mole/liter   (b) 10^{-12} mole/liter
    (c) 10^{-9} mole/liter   (d) 10^{-2} mole/liter

56. The CORRECT order of basicity of the following amines P, Q, R and S is
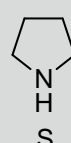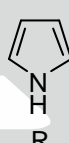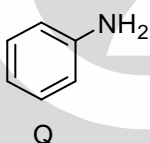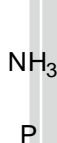
    (a) $S < P < Q < R$ (b) $R < Q < P < S$
    (c) $Q < P < R < S$ (d) $P < Q < S < R$

57. The values of x and y in the given structure of Nylon 66 are
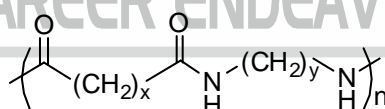
    (a) $x = 4$ and $y = 6$ (b) $x = 6$ and $y = 4$
    (c) $x = 6$ and $y = 6$ (d) $x = 4$ and $y = 4$

58. In the following transformations, the groups R^1, R^2 and R^3 are
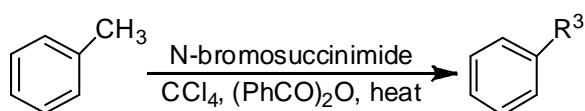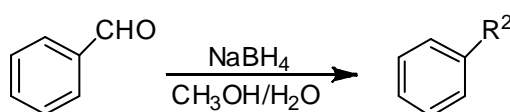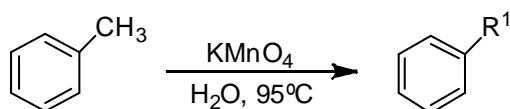
(a) $R^1 = CH_2OH$, $R^2 = CH_2Br$ and $R^3 = COOH$

(b) $R^1 = COOH$, $R^2 = CH_2Br$ and $R^3 = CH_2OH$

(c) $R^1 = COOH$, $R^2 = CH_2OH$ and $R^3 = CH_2Br$

(d) $R^1 = CH_2Br$, $R^2 = COOH$ and $R^3 = CH_2OH$

59. The correct match between items of Column-I and Column-II is

Column-I

P. Friedel-Crafts reaction

Q. Baeyer-Villiger reaction

R. Diels-Alder reaction

S. S_N2 reaction

Column-II

1. Cycloaddition

2. Walden inversion

3. Oxidation

4. Aromatic electrophilic substitution

(a) P-3, Q-2, R-1, S-4

(b) P-4, Q-3, R-1, S-2

(c) P-1, Q-2, R-3, S-4

(d) P-4, Q-3, R-2, S-1

60. The molecular shape of XeF_2 is

(a) trigonal bipyramidal

(b) trigonal pyramidal

(c) V-shape

(d) linear

61. The number of signals in the ^1H NMR spectra of the following molecules P and Q, respectively, are
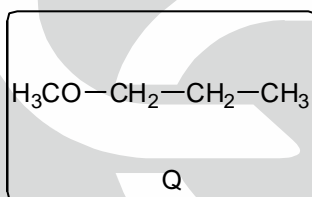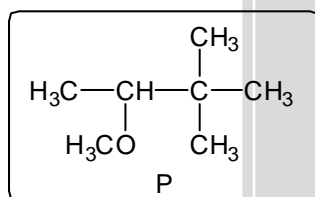
(a) 6 and 4   (b) 4 and 4   (c) 3 and 3   (d) 4 and 3

62. Which of the following can be used as a biological weapon?

P. *Bacillus anthracis*   Q. *Bacillus thuringiensis*

R. *Bacillus subtilis*   S. Ebola virus

(a) P and S   (b) P and Q   (c) P and R   (d) Q and S

63. The number of acetylated amino sugar(s) in the repeating unit of peptidoglycan is

(a) 1   (b) 2   (c) 3   (d) 4

64. The genome of an adenovirus is a

(a) linear double stranded DNA

(b) circular double stranded DNA

(c) plus-strand RNA

(d) minus-strand RNA

65. Which one of the following CANNOT be used to sterilize a heat-labile solution?

(a) Gamma radiation

(b) Ethylene oxide

(c) Autoclaving

(d) UV radiation

66. Which one of the following second messengers targets protein kinase A?

(a) cAMP

(b) cGMP

(c) Diacylglycerol

(d) Inositol 1, 4, 5-triphosphate

67.   Idiogram is
      (a) a diagrammatic representation of karyotype of a species
      (b) a diagrammatic representation of isotypic antibodies of a species
      (c) a diagrammatic representation of the evolutionary tree of various species
      (d) an autoradiogram profile of isotypic antibodies of a species obtained using [125][

68.   Spindle fibers, formed during the cell division, are composed of
      (a) actin   (b) collagen   (c) myosin   (d) tubulin

69.   The differential equation representing the family of circles passing through the points (0, –b) and
      (0, b) is

      (a) $x^2 - y^2 + 2xy\dfrac{dy}{dx} + b^2 = 0$ (b) $x^2 + y^2 + 2xy\dfrac{dy}{dx} + b^2 = 0$

      (c) $x^2 - y^2 - 2xy\dfrac{dy}{dx} + b^2 = 0$ (d) $x^2 + y^2 - 2xy\dfrac{dy}{dx} + b^2 = 0$

70.   The value of $\displaystyle\int_{-\pi}^{\pi} \dfrac{a^{\cos x}}{a^{\cos x} + a^{-\cos x}}\, dx$ is

      (a) $a^{-\pi}$ (b) a^{π} (c) $-\pi$ (d) π

71.   The point at which the tangent to the curve $x^3 + y^3 = 6xy$ is parallel to y-axis (but is not y-axis)
      is

      (a) $(4\sqrt[3]{2}, 2\sqrt[3]{2})$ (b) $(2\sqrt[3]{2}, 4\sqrt[3]{2})$ (c) $(2\sqrt[3]{2}, 2\sqrt[3]{4})$ (d) $(2\sqrt[3]{4}, 2\sqrt[3]{2})$

72.   For $p \geq 0$, $q \geq 0$, if the maximum of $px + qy$, subject to the constraints $0 \leq x$, $0 \leq y$, $x + 2y \leq 10$
      and $3x + y \leq 15$, exists at points (0, 5) and (4, 3), then the relationship between p and q is

      (a) $2p = q$ (b) $p = 2q$ (c) $p = 3q$ (d) $3p = q$

73.   The set of complex numbers z, which satisfy the equation $|z-3| + |z+3| = 10$ in the Argand
      plane, forms
      (a) a circle   (b) a parabola   (c) an ellipse   (d) a hyperbola

74.   If $(x + iy)^3 = u + iv$, then $\dfrac{u}{x} + \dfrac{v}{y}$ is

      (a) $4(x^2 + y^2)$ (b) $4(y^2 - x^2)$ (c) $4(x^2 - y^2)$ (d) $-4(x^2 + y^2)$

75.   Saji and Milind are on a treasure hunt. The probability that Saji will find it is $\dfrac{2}{3}$ and that both

      Saji and Milind will find it simultaneously is $\dfrac{1}{6}$. The probability that Saji alone finds it is

      (a) $\dfrac{1}{4}$ (b) $\dfrac{1}{2}$ (c) $\dfrac{3}{4}$ (d) $\dfrac{5}{6}$

76. Considering the equation $\Delta G^0 = \Delta H^0 - T\Delta S^0$, which one of the following statements is NOT CORRECT?

    (a) When ΔG^0 is negative, the reaction is exergonic

    (b) When ΔG^0 is negative, the reaction can occur spontaneously

    (c) When ΔS^0 is negative, the molecular disorder decreases during the reaction

    (d) When ΔH^0 is negative, the reaction is endothermic

77. The difference in the energies of the eclipsed and staggered conformations of ethane at 25ºC is approximately

    (a) 5.40 kcal/mole   (b) 2.70 kcal/mole

    (c) 0.54 kcal/mole   (d) 0.27 kcal/mole

78. Which one of the following statements is NOT CORRECT?

    (a) The second ionization potential of an atom is larger than its first ionization potential

    (b) Atomic size increases from top to bottom in a group of the periodic table

    (c) Electron affinity of an atom is the energy required to add an electron to its outermost orbit

    (d) Electronegativity of an atom is its ability to attract electrons towards itself

79. Name of the compound $[Co(NH_3)_6]Cl_3$ is

    (a) cobalt (III) hexaammine chloride   (b) hexaamminecobalt chloride (III)

    (c) hexaamminecobalt trichloride   (d)   hexaamminecobalt (III) chloride

80. Which one of the following molecules has dipole moment?

    (a) PCl_3 (b) BCl_3 (c) CO_2 (d) N_2

81. In a photochemical reaction, light is involved in

    (a) initiation step only   (b) propagation step only

    (c) termination step only   (d) propagation and termination steps

82. Proteasomes are

    (a) proteomes of lysosomes

    (b) protein complexes which recognize and degrade ubiquitinated proteins

    (c) protein and cholesterol complexes which help in cholesterol transport

    (d) protein and RNA complexes which are involved in mRNA splicing

83. For the function $f(x) = \begin{cases} -1 & 0 < x \leq 1 \\ 2 & 1 < x < 2 \\ x & 2 \leq x < 4 \end{cases}$

    (a) limit exists but is not continuous at 1   (b) limit exists and is continuous at 1

    (c) limit exists but is not continuous at 2   (d) limit exists and is continuous at 2

84. The minimum value of the function $x^3 - 6x^2 + 9x + 10$ in the interval [0, 4] is at

    (a) 1 only   (b) 1 and 3   (c) 0 and 3   (d) 3 only

85. The equation of the plane passing through the line of intersection of the planes $3x + 2y = 5$ and $x + y + 2z + 1 = 0$, and containing the point (1, 2, 3) is

(a) $14x - 9y + 2z = 2$ (b) $14x + 9y - 2z = 26$

(c) $9x + 14y - 2z = 31$ (d) $9x + 14y + 2z = 43$

86. If $\hat{a}$ and $\hat{b}$ are unit vectors inclined at an angle θ, then $|\hat{a} - \hat{b}|$ is

(a) $2\cos\dfrac{\theta}{2}$ (b) $2\sin\theta$ (c) $2\cos\theta$ (d) $2\sin\dfrac{\theta}{2}$

87. For $A = \begin{bmatrix} 1 & -2 & 0 \\ 2 & 3 & -1 \\ -3 & 1 & 4 \end{bmatrix}$, the value of the determinant of adjoint of A is

(a) 576   (b) 529   (c) 441   (d) 361

88. The converse of the statement "$x = 2$ implies $x^2 = 4$" is

(a) $x^2 = 4$ implies $x = 2$ (b) $x^2 = 4$ implies $x = -2$

(c) $x^2 = 4$ implies ($x = 2$ or $x = -2$)   (d) $x^2 = 4$ implies ($x = 2$ and $x = -2$)

89. The number of functions from the set $\{a, b, c, d\}$ to the set $\{1, 2, 3\}$ is

(a) 12   (b) 36   (c) 64   (d) 81

90. $\mathbb{N}$ is the set of natural numbers, $\mathbb{Z}$ is the set of integers, $\mathbb{Q}$ is the set of rational numbers, $\mathbb{R}$ is the set of real numbers and $\mathbb{C}$ is the set of complex numbers. There is a bijection between

(a) $\mathbb{N}$ and $\mathbb{Z}$ (b) $\mathbb{Z}$ and $\mathbb{R}$ (c) $\mathbb{R}$ and $\mathbb{Q}$ (d) $\mathbb{Q}$ and $\mathbb{C}$

91. The removal of bursa of Fabricius from a chicken results in
(a) a delayed rejection of skin graft
(b) low serum levels of antibodies
(c) anemia
(d) a marked decrease in the number of circulating T lymphocytes

92. A mouse, which lacks thymus, is called
(a) SCID mouse   (b) NUDE mouse
(c) BEIGE mouse   (d) CBA/N mouse

93. Which one of the following is a gratuitous inducer of the *lac* operon?
(a) Galactose-β (1, 6)-glucose   (b) Galactose-β (1, 4)-glucose
(c) *O*-Nitrophenylgalactoside   (d) Isopropyl-β-thiogalactoside

94. Which of the following statements pertaining to cell and tissue culture are CORRECT?
P. In a tissue culture incubator, increasing the partial pressure of CO_2 results in a decrease of the pH of the medium
Q. An inactive telomerase is required for a cell to achieve immortality
R. Antibiotics are added to the culture media to prevent microbial contamination
S. Hayflick limit refers to the number of cells that can grow in a culture flask
T. Serum proteins are required for the adhesion of cells to the surface of a solid substrate
(a) P, Q, S and T   (b) P, Q and T
(c) P, R and T   (d) Q, R and T

95.   In the schematic shown below, P, Q, R, S, T, U and V are metabolites.
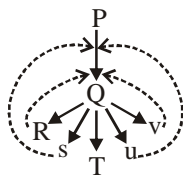
The dotted lines denote
(a) sequential feedback inhibition   (b) negative feedback inhibition
(c) repression   (d) cumulative feedback inhibition

96.   The correct match between items of Column I and Column II is

Column-I	**Column-II**
P. Co^{2+} (aq)	1. Colorless
Q. Zn^{2+} (aq)	2. Blue
R. Cu^{2+} (aq)	3. Pink
S. Ni^{2+} (aq)	4. Green

(a) P-3, Q-1, R-2, S-4   (b) P-4, Q-2, R-1, S-3
(c) P-3, Q-4, R-2, S-1   (d) P-2, Q-4, R-1, S-3

97.   Considering the acidities of the given molecules, which one of the following orders is NOT CORRECT?
(a) $CH_4 < NH_3 < H_2O < HF$ (b) $SiH_4 < PH_3 < H_2S < HCl$
(c) $HF < HCl < HBr < HI$ (d) $H_2O < H_2S < H_2Te < H_2Se$

98.   Which one of the following alcohols undergoes dehydration with rearrangement involving a methyl migration?

(a)

(b)

(c)

(d)

99.   Which one of the following compounds gives acetone as one of the products when treated sequentially with (i) O_3 and (ii) Me_2S?

(a)

(b)

(c)

(d)

100.   The units of rate constant (k) of a reaction are $\left(\dfrac{\text{liters}}{\text{mole}}\right)^x \dfrac{1}{s}$. If the order of the reaction is $\dfrac{3}{2}$, the value of x is

(a) 0   (b) $\dfrac{1}{2}$ (c) 1   (d) $\dfrac{3}{2}$