

**MEGA
Solution
Series**

2nd Edition



Volume I

Biotechnology Biochemistry Microbiology

covers following examinations

- **IIT - JAM Biotechnology**
- **TIFR - NCBS JGEEBILS Biology**
- **IIT - JAM Biological Science**

**Editor
Kar Debasish**

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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 is aggregated and P3 is folded

- 2.. EnzP, EnzQ, EnzR, and EnzS catalyze the metabolic reactions as shown below:

EnzP	$\text{HOOC}-\text{CH}_2-\text{CH}_2-\text{COOH} \rightarrow \text{HOOC}-\text{CH}=\text{CH}-\text{COOH}$ Succinic acid Fumaric acid
EnzQ	$\text{HOOC}-\text{CH}(\text{OH})-\text{CH}_2-\text{COOH} \rightarrow \text{HOOC}-\text{C}(=\text{O})-\text{CH}_2-\text{COOH}$ Malic acid Oxaloacetic acid
EnzR	$\text{HOOC}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{COOH} \rightarrow \text{HOOC}-\text{CH}_2-\text{CH}_2-\text{CH}(\text{COOH})-\text{COOH}$ Glutamic acid γ-carboxyglutamic acid
EnzS	$\text{H}_2\text{N}-\text{CH}(\text{COOH})-\text{R}_1 + \text{O}=\text{C}-\text{R}_2 \rightarrow \text{O}=\text{C}-\text{R}_1 + \text{H}_2\text{N}-\text{CH}(\text{COOH})-\text{R}_2$ Transamination

Each of the above enzymes is dependent on one of the following four vitamins (either the vitamin itself or its derivative):

VitB2: Vitamin B2 (riboflavin)

VitB3: Vitamin B3 (niacin)

VitB6: Vitamin B6 (Pyridoxal)

VitK: Vitamin K

Which one of the following options gives the correct enzyme-vitamin matches?

- (a) EnzP and vitB3, EnzQ and VitB2, EnzR and VitB6, EnzS and VitK
 (b) EnzP and VitB2, EnzQ and VitB3, EnzR and VitB6, EnzS and VitK
 (c) EnzP and VitB2, EnzQ and VitB3, EnzR and VitK, EnzS and VitB6
 (d) EnzP and VitB6, EnzQ and VitB2, EnzR and VitB3, EnzS and VitK
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 $\left(\frac{C_p}{C_v} = 1.5\right)$ at a higher pressure P and temperature T , is suddenly released to atmosphere. The final temperature of the gas (in units of atm) 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 30° with the ground. Assume $g = 10 \text{ m/sec}^2$. The ball will reach to a maximum height (in meters) of
 (a) 20 (b) 40 (c) 60 (d) 80
6. The dimensions ML^2T^{-2} DO NOT correspond to
 (a) work (b) torque
 (c) heat (d) angular momentum
7. $\lim_{n \rightarrow \infty} \left(\frac{1}{n} + \frac{n^2}{(n+1)^3} + \frac{n^2}{(n+2)^3} + \dots + \frac{1}{8n} \right)$ is
 (a) $\frac{1}{8}$ (b) $\frac{1}{4}$ (c) $\frac{3}{8}$ (d) $\frac{1}{2}$
8. Given that $Z = X^2 + Y^2$, the value of $\partial Z / \partial X$ for $X = 1$ and $Y = 0$ is
 (a) 0 (b) 1 (c) 2 (d) 10

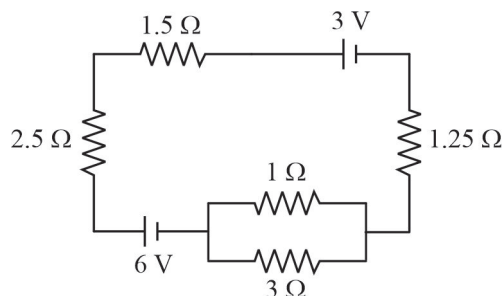
9. Suppose the principal increases continuously at the rate of $r\%$ per year. If Rs.100 doubles in 10 years, then r is
 (a) $5 \log_e 2$ (b) $10 \log_e 2$
 (c) $50 \log_e 2$ (d) $100 \log_e 2$
10. A eukaryotic cell lacking active telomerase
 (a) will be unable to proofread incorrectly-added nucleotides
 (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 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 a 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 systematic 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
 (b) Helicobacter pylori and human papilloma virus
 (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. The elemental composition of dry biomass of a yeast species is $\text{CH}_{1.6}\text{O}_{0.4}\text{N}_{0.2}\text{S}_{0.0024}\text{P}_{0.017}$. The contribution of carbon to the dry biomass is _____ % (round off to 2 decimal places)
 (a) 20 (b) 31 (c) 40 (d) 51

22. The current (in A) in the given circuit, assuming the internal resistance of the batteries to be negligible, is



- (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) $\frac{9}{8}$

23. Solvent A and B are completely immiscible. Solute S is soluble in both these solvents. 100 g of S was added to a container which has 2 kg each of A and B. The solute is 1.5 times more soluble in solvent A than in solvent B. The mixture was agitated thoroughly and allowed to reach equilibrium. Assuming that the solute has completely dissolved, the amount of solute in solvent A phase is

- (a) 30 gm (b) 40 gm (c) 50 gm (d) 60 gm

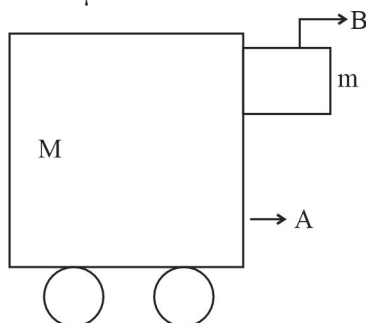
24. The terminal speed (in m/s) of a vertically falling raindrop of radius 0.03 cm ($g = 9.9 \text{ m/s}^2$, $\eta_{\text{air}} = 1.8 \times 10^{-4} \text{ poise}$ and $\rho_{\text{water}} = 1000 \text{ kg/m}^3$) is approximately

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

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

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

26. For the figure given below find the maximum acceleration of the cart that is require to prevent block B from falling coefficient of Static Friction between block and cart is μ_s



- (a) g (b) $\mu_s g$
(c) g/μ_s (d) None of above

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 on cyclins
(d) an increase in the ratio of the cell volume and genome

29. Which of the following statements are true regarding the dolichol phosphate pathway?

- P. A 14-residue precursor oligosaccharide chain is synthesized in the ER
Q. A 14-residue precursor oligosaccharide 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) P and Q
(c) R and S (d) Q and R

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'-3' polymerase activity
(c) It has 3'-5' exonuclease activity
(d) It has 5'-3' exonuclease activity

31. In which one of the following options are the cellular compartments arranged in the increasing order to 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 entires 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) trophic structure
(d) species richness

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 entires in Column I and 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

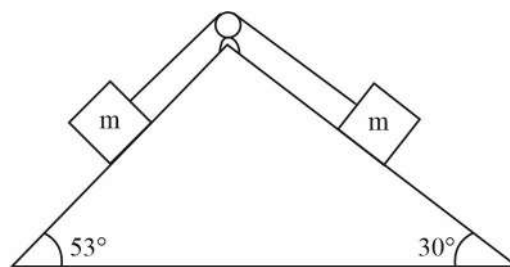
38. A particle of mass M , originally at rest is subjected to a force whose direction is constant but whose magnitude varies with the time according to the relation

$$F = F_0 \left[1 - \left(\frac{t-T}{R} \right)^2 \right]$$

where F_0 and T are constant. The force acts only for the time interval $2T$. Find the velocity v of the particle after time $2T$

- (a) $F_0/3M_0$ (b) $4F_0/3M_0$
(c) $F_0/2M_0$ (d) none of the above

39. Consider the figure given below



if Coefficient of friction is μ then what is the least value of μ so the system remains at rest

- (a) 0.23 (b) 0.2 (c) 0.203 (d) 0.13

40. A body of mass m moves along the positive x -axis, it starts at velocity v_0 at $t = 0$ and it is the origin initially. It is acted by the force such that

$$F = -kv$$

find the time in which it will come to rest

- (a) $t \rightarrow \infty$ (b) $t = kt/m$
(c) $t = mt/k$ (d) none of the above

41. Find the value of x at which it velocity become 0

- (a) mv_0/k (b) mv_0/k^2
(c) m/kv_0 (d) none of the above

42. A 6 kg object is subject to three forces

$$F_1 = 20\mathbf{i} + 30\mathbf{j} \text{ N}$$

$$F_2 = 8\mathbf{i} - 50\mathbf{j} \text{ N}$$

$$F_3 = 2\mathbf{i} + 2\mathbf{j} \text{ N}$$

find the acceleration of object

- (a) $5\mathbf{i} + 3\mathbf{j}$ (b) $5\mathbf{i} - 3\mathbf{j}$ (c) $3\mathbf{i} + 5\mathbf{j}$ (d) $3\mathbf{i} - 5\mathbf{j}$

43. Which of the following expression is correct if at $t = 0$, object is at origin and velocity is $v_0 = i + j$
- (a) $r = i(2.5 t^2 + t) + j(t - 1.5 t^2)$
 (b) $r = i(2.5 t^2 - t) + j(t + 1.5 t^2)$
 (c) $r = it - jt^2$
 (d) none of the above

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?

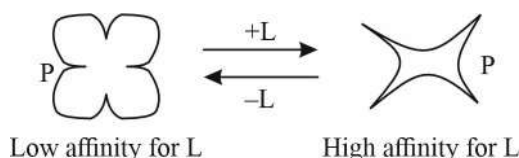
P. Autologous

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,



- (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 the 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. What happens to the weight of the body if the weight becomes $1/16$ at a certain. Also, consider the radius of the earth to be R.

- (a) 4R (b) 15R (c) 5R (d) 3R

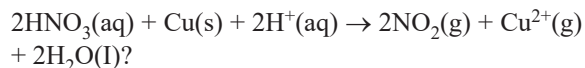
51. A ball bounces to 80% of its original height. What fraction of its mechanical energy is lost in each bounce?

- (a) 0.2 (b) 0.4 (c) 0.6 (d) 0.8

52. Find the value of p so that the vectors $A = 2i + pj + k$ and $B = 4i - 2j - 2k$ are perpendicular to each other

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

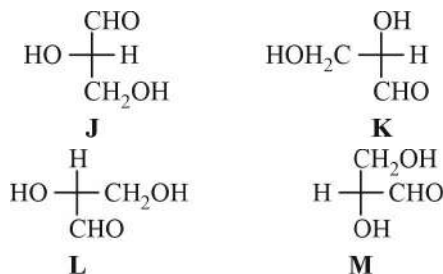
53. Which one of the following statements is CORRECT for the reaction



- (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

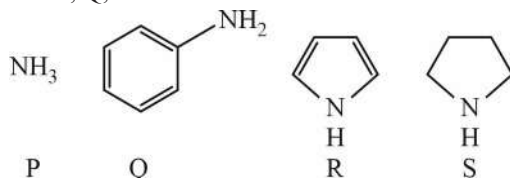


54. Which of the following Fischer projections of glyceraldehyde have identical absolute configuration?

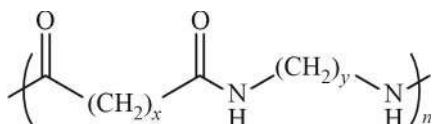


- (a) K, L and M (b) J, K and M
(c) J, K and L (d) J, L and M
55. In a water solution, the concentration of OH^- at 25°C is 10^{-5} mole/liter. The concentration of H_3O^+ is
- (a) 10^{-19} mole/liter (b) 10^{-12} mole/liter
(c) 10^{-9} mole/liter (d) 10^{-2} mole/liter

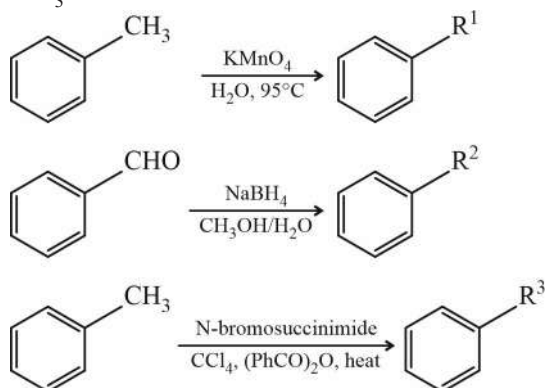
56. The CORRECT order of basicity of the following amines P, Q, R and S is



- (a) $\text{S} < \text{P} < \text{Q} < \text{R}$ (b) $\text{R} < \text{Q} < \text{P} < \text{S}$
(c) $\text{Q} < \text{P} < \text{R} < \text{S}$ (d) $\text{P} < \text{Q} < \text{S} < \text{R}$
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

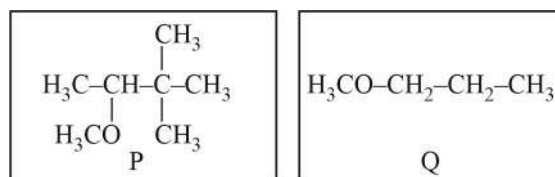


- (a) $\text{R}^1 = \text{CH}_2\text{OH}$, $\text{R}^2 = \text{CH}_2\text{Br}$ and $\text{R}^3 = \text{COOH}$
(b) $\text{R}^1 = \text{COOH}$, $\text{R}^2 = \text{CH}_2\text{Br}$ and $\text{R}^3 = \text{CH}_2\text{OH}$
(c) $\text{R}^1 = \text{COOH}$, $\text{R}^2 = \text{CH}_2\text{OH}$ and $\text{R}^3 = \text{CH}_2\text{Br}$
(d) $\text{R}^1 = \text{CH}_2\text{Br}$, $\text{R}^2 = \text{COOH}$ and $\text{R}^3 = \text{CH}_2\text{OH}$

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

Column-I		Column-II	
P.	Friedel-Crafts reaction	1.	Cycloaddition
Q.	Baeyer-Villiger reaction	2.	Walden inversion
R.	Diels-Alder reaction	3.	Oxidation
S.	SN_2 reaction	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 trees of various species
 (d) an autoradiogram profile of isotypic antibodies of a species obtained using ^{125}I
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) $x^2 - y^2 + 2xy\left(\frac{dy}{dx}\right) + b^2 = 0$
 (b) $x^2 + y^2 + 2xy\left(\frac{dy}{dx}\right) + b^2 = 0$
 (c) $x^2 - y^2 - 2xy\left(\frac{dy}{dx}\right) + b^2 = 0$
 (d) $x^2 + y^2 - 2xy\left(\frac{dy}{dx}\right) + b^2 = 0$
70. A geostationary satellite is orbiting the earth at a height of $6R$ above the surface of the earth, R being the radius of the earth. The time period of another satellite at a height of $2.5 R$ from the surface of earth is
 (a) $6\sqrt{2}$ hr (b) 6 hr (c) $5\sqrt{2}$ hr (d) 10 hr
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 $\frac{u}{x} + \frac{v}{y}$ 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 $\frac{2}{3}$ and that both Saji and Milind will find it simultaneously is $\frac{1}{6}$. The probability that Saji alone finds it is
 (a) — (b) $\frac{1}{2}$
 (c) $\frac{3}{4}$ (d) $\frac{5}{6}$
76. Considering the equation $\Delta G_0 = \Delta H_0 - \Delta S_0$ 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 25°C 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 $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ 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. Proteosomes are

- (a) Proteosome 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 $x^2 - 6x^2 + 9x + 10$ in the interval $[0, 4]$ is at

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

85. A satellite is orbiting close to the surface of the earth, then its speed is

- (a) $\sqrt{2gR}$ (b) Rg
- (c) $\sqrt{Rg}$ (d) $\sqrt{\frac{Rg}{2}}$

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

$$|\hat{a} - \hat{b}| \text{ is}$$

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

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 $(x = 2 \text{ or } x = -2)$
- (d) $x^2 = 4$ implies $(x = 2 \text{ and } x = -2)$

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 $\mathbb{C}$

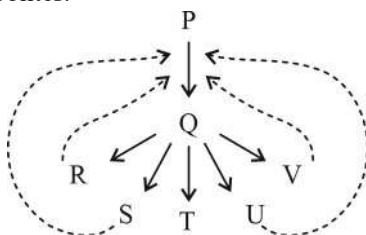
91. The removal of bursa of Fabricius from a chicken results in

- (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

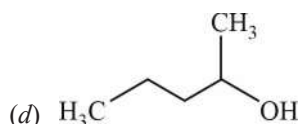
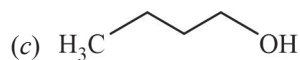
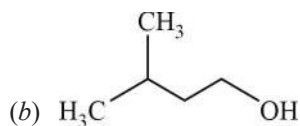
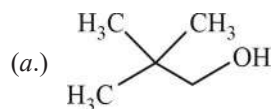
93. Which one of the following is a gratuitous inducer of the lac operon?
- Galactose- β (1,6)-glucose
 - Galactose- β (1,4)-glucose
 - O-Nitrophenylgalactoside
 - Isopropyl- β -thiogalactoside
94. Which of the following statements pertaining to cell and tissue culture are correct?
- P. In a tissue culture 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 culture flask
- T. Serum proteins are required for the adhesion of cells to the surface of a solid substrate
- P, Q, S and T
 - P, Q and T
 - P, R and T
 - Q, R and T
95. In the schematic shown below P, Q, R, S, T, U and V are metabolites.



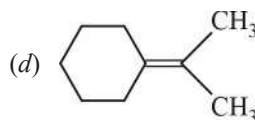
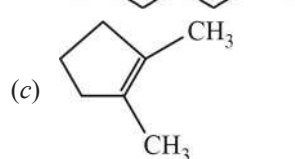
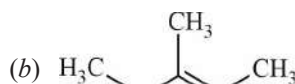
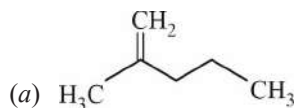
The dotted lines denote

- sequential feedback inhibition
 - negative feedback inhibition
 - repression
 - 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 |
- P-3, Q-1, R-2, S-4
 - P-4, Q-2, R-1, S-3
 - P-3, Q-4, R-2, S-1
 - 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?
- $\text{CH}_4 < \text{NH}_3 < \text{H}_2\text{O} < \text{HF}$
 - $\text{SiH}_4 < \text{PH}_3 < \text{H}_2\text{S} < \text{HCl}$
 - $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$
 - $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Te} < \text{H}_2\text{Se}$
98. Which one of the following alcohols undergoes dehydration with rearrangement involving a methyl migration?



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 ?



100. The units of rate constant (k) of a reaction are $\left(\frac{\text{liters}}{\text{mole}}\right)^x \frac{1}{\text{s}}$. The units of rate constant (k) of a reaction are $\left(\frac{\text{liters}}{\text{mole}}\right)^x \frac{1}{\text{s}}$. If the order of the reaction is $\frac{3}{2}$, the value of x is
- 0
 - $\frac{1}{2}$
 - 1
 - $\frac{3}{2}$

Answer Keys

Chapter-01 : Mock Paper Biology/Biotechnology- 01

1. (a)	2. (a)	3. (c)	4. (a)	5. (a)	6. (a)	7. (d)	8. (a)	9. (c)	10. (b)
11. (c)	12. (a)	13. (b)	14. (c)	15. (a)	16. (b)	17. (d)	18. (d)	19. (a)	20. (b)
21. (d)	22. (c)	23. (b)	24. (c)	25. (c)	26. (c)	27. (c)	28. (d)	29. (c)	30. (c)
31. (b)	32. (b)	33. (b)	34. (b)	35. (b)	36. (d)	37. (b)	38. (c)	39. (b)	40. (a)
41. (c)	42. (b)	43. (c)	44. (c)	45. (c)	46. (c)	47. (a)	48. (b)	49. (d)	50. (b)
51. (c)	52. (a)	53. (b)	54. (b)	55. (d)	56. (a)	57. (b)	58. (d)	59. (b)	60. (d)

Chapter-02 : Mock Paper Biology/Biotechnology- 02

1. (a)	2. (b)	3. (b)	4. (d)	5. (c)	6. (a)	7. (b)	8. (a)	9. (b)	10. (d)
11. (c)	12. (c)	13. (a)	14. (c)	15. (b)	16. (d)	17. (b)	18. (a)	19. (c)	20. (b)
21. (c)	22. (b)	23. (d)	24. (c)	25. (b)	26. (a)	27. (d)	28. (d)	29. (c)	30. (a)
31. (a)	32. (a)	33. (d)	34. (b)	35. (a)	36. (b)	37. (c)	38. (a)	39. (c)	40. (c)
41. (d)	42. (d)	43. (b)	44. (b)	45. (d)	46. (a)	47. (b)	48. (b)	49. (a)	50. (b)
51. (a)	52. (d)	53. (c)	54. (c)	55. (b)	56. (a)	57. (a)	58. (a)	59. (b)	60. (a)

Chapter-03 : Mock Paper Biology/Biotechnology- 03

1. (b)	2. (c)	3. (b)	4. (c)	5. (d)	6. (a)	7. (b)	8. (d)	9. (c)	10. (b)
11. (a)	12. (d)	13. (a)	14. (c)	15. (a)	16. (b)	17. (b)	18. (a)	19. (b)	20. (d)
21. (c)	22. (d)	23. (a)	24. (d)	25. (c)	26. (a)	27. (b)	28. (a)	29. (b)	30. (c)
31. (c)	32. (c)	33. (a)	34. (c)	35. (c)	36. (c)	37. (b)	38. (a)	39. (c)	40. (b)
41. (d)	42. (c)	43. (c)	44. (a)	45. (a)	46. (b)	47. (c)	48. (c)	49. (c)	50. (d)
51. (c)	52. (c)	53. (a)	54. (d)	55. (c)	56. (c)	57. (b)	58. (a)	59. (a)	60. (c)

Chapter-04 : Mock Paper Biology/Biotechnology- 04

1. (b)	2. (a)	3. (c)	4. (b)	5. (d)	6. (b)	7. (a)	8. (a)	9. (d)	10. (b)
11. (c)	12. (d)	13. (d)	14. (c)	15. (a)	16. (a)	17. (b)	18. (c)	19. (d)	20. (c)
21. (c)	22. (c)	23. (d)	24. (d)	25. (c)	26. (c)	27. (d)	28. (a)	29. (d)	30. (d)
31. (d)	32. (b)	33. (c)	34. (b)	35. (b)	36. (c)	37. (a)	38. (b)	39. (c)	40. (b)
41. (b)	42. (b)	43. (c)	44. (a)	45. (b)	46. (c)	47. (c)	48. (c)	49. (b)	50. (b)
51. (b)	52. (b)	53. (b)	54. (c)	55. (d)	56. (c)	57. (a)	58. (c)	59. (c)	60. (d)

Explanations

Chapter-1 : Mock Paper Biology/Biotechnology- 01

1. (a) At low substrate concentration, the rate of a reaction is determined by the rate of formation of an enzyme-substrate complex.
2. (a) The Gibbs free energy change (ΔG) must have a negative value for a process to occur spontaneously. Melting of ice and evaporation of water are the two spontaneous processes at room temperature.
3. (c) $K_w = [H^+][OH^-]$ Solving for $[OH^-]$ gives $[OH^-] = (K_w) / ([H^+]) = (1.0 \times 10^{-14}) / (1.3 \times 10^{-4}) M = 7.7 \times 10^{-11} M$.
4. (a) On dilution pH of buffer solution remains unchanged because the ratio of concentration of salt and acid or base remains unchanged.
5. (a) Buffer capacity = number of moles of acid or base added to 1 liter of buffer/change in pH.
6. (a) Precursor for the biosynthesis of abscisic acid is violaxanthin, a type of xanthophyll found in leaves.
7. (d) Oxysomes which are also called as $F_0 - F_1$ particles are present on the surface of the folded inner mitochondrial membrane.
8. (a) Mitochondrial DNA is one of the best marker tools for population biologists and evolutionary biologists because of the absence of genetic recombination in mt-DNA.
9. (c) Sequence tagged site is a short DNA sequence having single occurrence in genome. Cotig is a set of overlapping DNA segments that together represent a consensus region of DNA. YAC is a linear DNA molecule.
10. (b) 'A' blood group individuals have N-acetylgalactosamine sugar attachment.
11. (c) Both Thr and Tyr are phosphorylated to activate the protein kinase ERK.
12. (a) NO is a short-lived messenger that acts by stimulating a soluble guanylyl cyclase, raising [cGMP] and stimulating PKG.
13. (b) Glycosylation is the enzymatic process that links saccharides to produce glycans. N-linked glycans attached to the amide nitrogen of asparagine side chain and O-linked glycans attached to the hydroxyl oxygen of serine and threonine side chain.
14. (c) Ac/Ds (Activator-Dissociator) The first transposable element system recognized on the basis of its genetic behavior in maize, it was on the basis of studies on this system that Barbara McClintock proposed the concept of transposable elements. There are several Ac and Ds transposons cloned and sequenced. Ac stands for activator and Ds for dissociator. Both of them represent transposons and are part of the same system. However, they function in different ways. The Ds element, mainly found within coding sequence of a gene, is incapable of excising itself from the gene and therefore mutant alleles harboring a Ds element are usually stable. Ac elements are capable of excising themselves from the position where they reside and move elsewhere, causing the allele to revert to the dominant type after excision. If they land up within a new gene after the transposition event, Ac elements create a mutation in the gene. This is now detected as a recessive allele.
15. (a) IgG is the only isotype that can pass through the human placenta, thereby providing protection to the fetus. Along with IgA secreted in the milk from breast, residual IgG absorbed through the placenta provides the neonate with antibody-mediated immunity or humoral immunity before its own immune system develops.
16. (b) Bilirubin is the yellow breakdown product of heme. Heme is found in hemoglobin, a principal component of red blood cells. Bilirubin is excreted in bile.
17. (d) 2,4-Dinitrophenol (DNP) is an uncoupling agent. Uncoupling agents uncouple oxidation from phosphorylation. DNP diffuses readily across mitochondrial membranes due to hydrophobic nature. After entering the matrix in the protonated form, they can release a proton, thus dissipating the proton gradient and thus ATP synthesis.

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Volume II



Biotechnology Biochemistry Microbiology

covers following examinations

- **GAT-B Biotechnology**
- **JNU CEEB Biotechnology**
- **JNU Life Science**
- **GRE Biology**
- **SAT/AP Biology**

**Editor
Kar Debasish**

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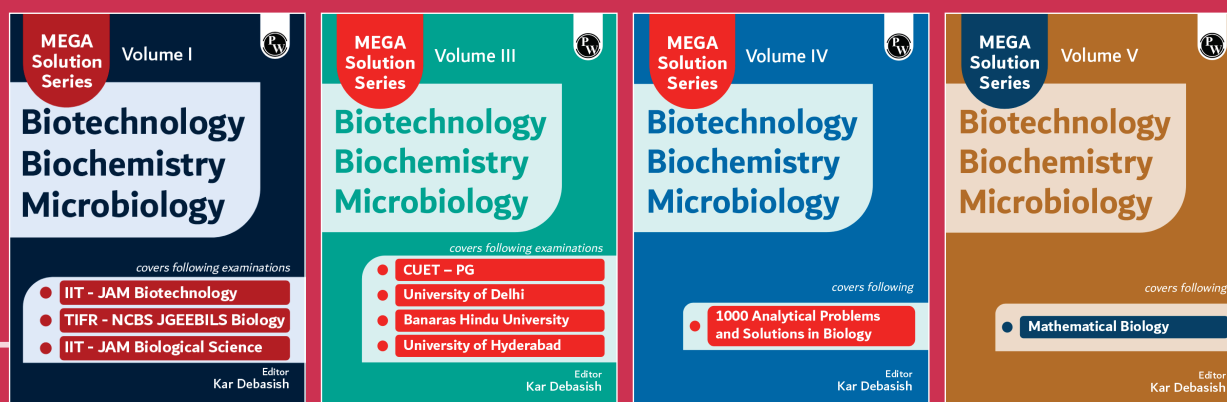
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