GATE 2010
XL: Life Sciences

EE25BTECH11049 - Sai Krishna Bakki

1. The question below consists of a pair of related words followed by four pairs of words. Select the pair that best expresses the relation in the original pair. **Unemployed : Worker**

(GATE XL 2010)

(A) fallow : land
(B) unaware : sleeper
(C) wit : jester
(D) renovated : house

2. Choose the most appropriate word from the options given below to complete the following sentence: His rather casual remarks on politics _____ his lack of seriousness about the subject.

(GATE XL 2010)

(A) masked
(B) belied
(C) betrayed
(D) suppressed

3. Which of the following options is the closest in meaning to the word below:
Circuitous

(GATE XL 2010)

(A) cyclic
(B) indirect
(C) confusing
(D) crooked

4. 25 persons are in a room. 15 of them play hockey, 17 of them play football and 10 of them play both hockey and football. Then the number of persons playing neither hockey nor football is

(GATE XL 2010)

(A) 2
(B) 17
(C) 13
(D) 3

5. Choose the most appropriate word from the options given below to complete the following sentence: If we manage to _____ our natural resources, we would leave a better planet for our children.

(GATE XL 2010)

(A) rebuild
(B) restrain
(C) cherish
(D) conserve

6. 5 skilled workers can build a wall in 20 days; 8 semi-skilled workers can build a wall in 25 days; 10 unskilled workers can build a wall in 30 days. If a team has 2 skilled, 6 semi-skilled and 5 unskilled workers, how long will it take to build the wall?

(GATE XL 2010)

(A) 20 days
(B) 18 days
(C) 16 days
(D) 15 days

7. Given digits $2, 2, 3, 3, 3, 4, 4, 4, 4$, how many distinct 4 digit numbers greater than 3000 can be formed?

(GATE XL 2010)

(A) 50 (B) 51 (C) 52 (D) 54

8. If 137 + 276 = 435 how much is 731 + 672?

(GATE XL 2010)

(A) 534 (B) 1403 (C) 1623 (D) 1513

9. Hari (*H*), Gita (*G*), Irfan (*I*) and Saira (*S*) are siblings (i.e. brothers and sisters). All were born on 1st January. The age difference between any two successive siblings (that is born one after another) is less than 3 years. Given the following facts:
i. Hari's age + Gita's age > Irfan's age + Saira's age.
ii. The age difference between Gita and Saira is 1 year. However, Gita is not the oldest and Saira is not the youngest.
iii. There are no twins.
In what order were they born (oldest first)?

(GATE XL 2010)

(A) HSGI
(B) SGHI
(C) IGSH
(D) IHSG

10. Modern warfare has changed from large scale clashes of armies to suppression of civilian populations. Chemical agents that do their work silently appear to be suited to such warfare; and regretfully, there exist people in military establishments who think that chemical agents are useful tools for their cause. Which of the following statements best sums up the meaning of the above passage:

(GATE XL 2010)

(A) Modern warfare has resulted in civil strife.
(B) Chemical agents are useful in modern warfare.
(C) Use of chemical agents in warfare would be undesirable.
(D) People in military establishments like to use chemical agents in war.

11. For a spontaneous process, the total entropy change $\left(\Delta S_{\text{system}} + \Delta S_{\text{surroundings}}\right)$ is

(GATE XL 2010)

(A) equal to zero
(B) greater than zero
(C) less than zero for endothermic process
(D) less than zero for exothermic process

12. A battery delivers a steady current of $1.25\,A$ for 90 minutes. The total charge Q (in Coulomb units) is

(GATE XL 2010)

(A) 6750 (B) 1012.5 (C) 112.5 (D) 12.5

13. Molecule that has no lone pair of electrons on the central atom (among the choices) is

(GATE XL 2010)

(A) XeF_4 (B) PF_5 (C) ClF_3 (D) BF_3

14. The oxidation state of nickel atom in the coordination compound $(Ni(NH_3)_6Cl_2)$ is

(GATE XL 2010)

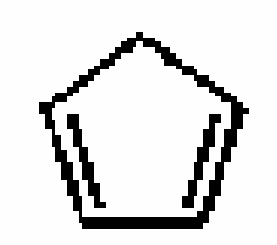
(A) -1 (B) 0 (C) $+1$ (D) $+2$

15. The compound that is aromatic, among the choices, is

(GATE XL 2010)

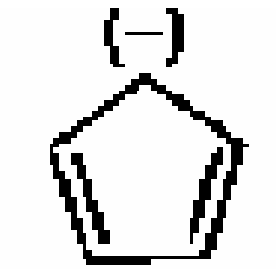
(A)

(B)



(C)

(D)



16. Consider the following equilibrium reaction:

$CO\ (g) + Cl_2\ (g) \longleftrightarrow COCl_2\ (g)$

0.60 atm of CO and 1.10 atm of Cl_2 were mixed in a constant volume reaction vessel at a particular temperature. After the equilibrium was established, 0.10 atm of $COCl_2$ was observed. The equilibrium constant for the reaction is

(GATE XL 2010)

(A) 0.02 (B) 0.15 (C) 0.2 (D) 6.6

17. For a particular reaction, the use of a catalyst reduces the activation energy (E_a) to one-third its original value. The ratio of rate constants $\left(K_{\text{catalysed}}/K_{\text{uncatalysed}}\right)$ is

(GATE XL 2010)

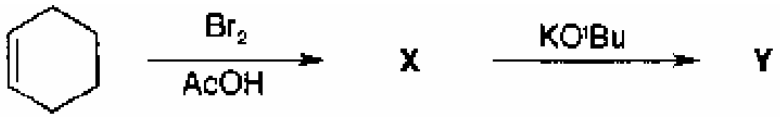
(A) 1 (B) $\frac{1}{3}$ (C) $\exp\left(\frac{2E_a}{3RT}\right)$ (D) $\exp\left(\frac{E_a}{3RT}\right)$

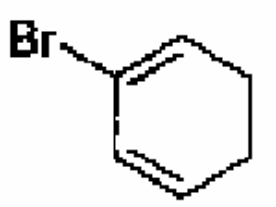
18. Among heptan-1-ol, heptan-2-ol, heptan-3-ol and heptan-4-ol, compounds those exhibit optical activity are

(GATE XL 2010)

(A) heptan-2-ol and heptan-3-ol
(B) heptan-2-ol and heptan-4-ol
(C) heptan-3-ol and heptan-4-ol
(D) heptan-1-ol and heptan-4-ol

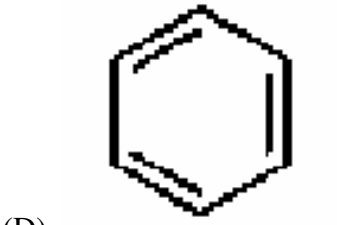
19. Structure of the compound Y in the following reaction sequence is (GATE XL 2010)



(A) 

(B) 

(C) 

(D) 

20. The ionization energy follows the order (GATE XL 2010)

(A) $O_2^+ > O > O_2^- > O_2^{2-}$
(B) $O_2^- > O_2^+ > O_2 > O_2^{2-}$
(C) $O^- > O_2^- > O_2^+ > O_2$
(D) $O_2^{2-} > O_2^- > O_2 > O_2^+$

21. Reaction of Na_2S with 2 equivalents of HCl produces a gas X. Solution of X in water is acidic in nature. X is (GATE XL 2010)

(A) O_2
(B) Cl_2
(C) SO_2
(D) H_2S

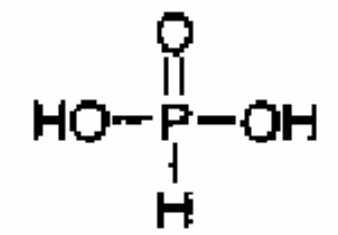
k

22. For a dilute solution of pho sphorous acid in a pH 5 buffer, the predominant species is (GATE XL 2010)

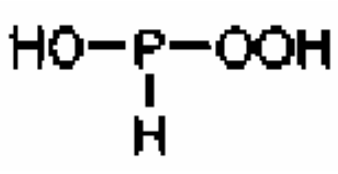
(A) H_3PO_3
(B) $H_2PO_3^-$
(C) HPO_3^{2-}
(D) PO_3^{3-}

23. The structure of phosphorous acid is (GATE XL 2010)

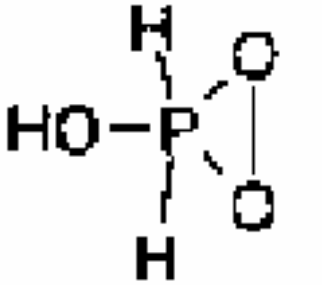
(A)



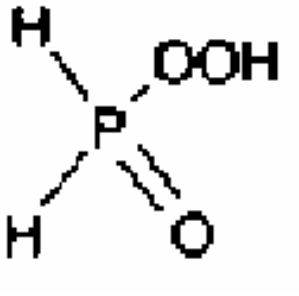
(B)



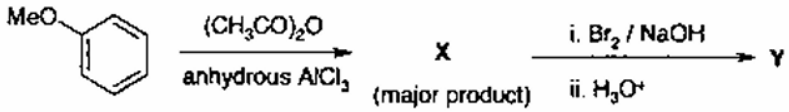
(C)



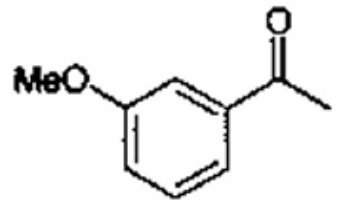
(D)



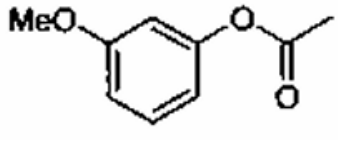
24. The structure of X in the above reaction sequence is (GATE XL 2010)



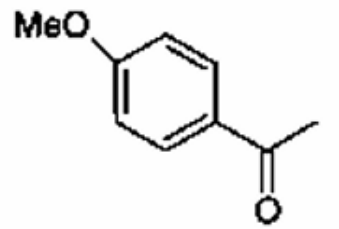
(A)



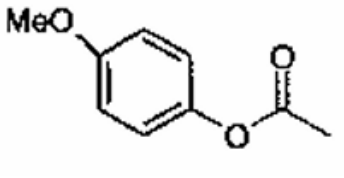
(B)



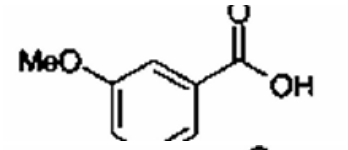
(C)

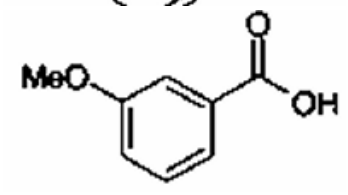


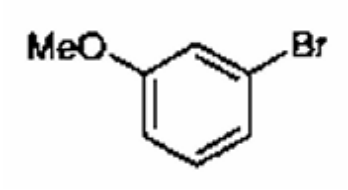
(D)

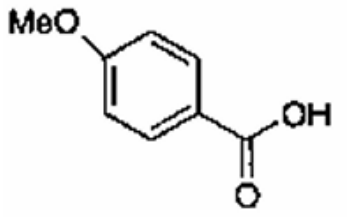


25. The structure of Y in the above reaction sequence is (GATE XL 2010)

(A) 

(B) 

(C) 

(D) 

26. Nucleolus is involved in the synthesis of (GATE XL 2010)

(A) rRNA (B) tRNA (C) DNA (D) mRNA

27. In tryptophan operon, tryptophan acts as (GATE XL 2010)

(A) Repressor (B) Activator (C) Co-repressor (D) Co-activator

28. Positive selection of T cells ensures (GATE XL 2010)

(A) MHC restriction
(B) Self tolerance
(C) TCR engagements
(D) Activation by co-stimulatory signal

29. A DNA-binding motif is (GATE XL 2010)

(A) Helix-loop-helix
(B) Helix-turn-helix
(C) Helical wheel
(D) Loop-helix-loop

30. Amino acids responsible for N-linked and O-linked glycosylation of proteins are (GATE XL 2010)

(A) Asparagine and Aspartic acid
(B) Glutamine and Serine
(C) Glutamic acid and Serine
(D) Asparagine and Threonine

31. One of the following compounds is NOT a neurotransmitter (GATE XL 2010)

(A) Dopamine
(B) Glutamic acid
(C) Histidine
(D) Glycine

32. Approximate molecular weight (kDa) of the product after translation of a 390 bases mRNA will be (GATE XL 2010)

(A) 48 (B) 26 (C) 39 (D) 14

33. Lineweaver-Burk plot is a plot of (GATE XL 2010)

(A) $\frac{1}{V_0}$ vs $\frac{1}{S}$
(B) V_0 vs $\frac{1}{S}$
(C) V_0 vs S
(D) $\frac{1}{V_0}$ vs S

34. A mixture of proteins (W, X, Y, Z) elute from Sephadex G-200 column in the order W, X, Y, Z. The protein with maximum electrophoretic mobility on SDS-PAGE will be (GATE XL 2010)

(A) W (B) X (C) Y (D) Z

35. Specific precursor for all prostaglandins is (GATE XL 2010)

(A) Oleic acid
(B) Arachidonic acid
(C) Palmitic acid
(D) α-Linolenic acid

36. Chymotrypsin and lysozyme are involved respectively in (GATE XL 2010)

P Removal of successive carboxyl terminal residues
Q Hydrolytic cleavage of peptide bond
R Cleavage of glycosidic C-O bond
S Oxygen transport in bloo

(A) P, Q
(B) Q, R
(C) Q, S
(D) R, S

37. Match the items in Group 1 with those in Group 2 (GATE XL 2010)

Group 1	**Group 2**
P. Isotype switching	1. V_H domain
Q. Clonal anergy	2. Non-responsive to self antigen
R. Class II MHC	3. Non-responsive TH cells
S. Self tolerance	4. β_2 microglobulin

(A) P-1, Q-4, R-3, S-2
(B) P-2, Q-4, R-1, S-3
(C) P-1, Q-3, R-4, S-2
(D) P-2, Q-1, R-3, S-4

38. Multiple RNA polymerase transcribes a DNA template, unwinding about 1.5 turns of DNA template per transcription bubble. From the structural information of classical B-DNA, how many transcription bubbles are possible for a 180 base pair DNA molecule? (GATE XL 2010)

(A) 12 (B) 27 (C) 6 (D) 270

39. Match the items in Group 1 with the most appropriate separation techniques in Group 2 (GATE XL 2010)

Group 1	**Group 2**
P. Mixture of glycine and albumin	1. Gas chromatography
Q. Mixture of 20 and 60 kDa proteins	2. Dialysis
R. Ribosomes from nuclear extract	3. Affinity chromatography
S. Lectins	4. Size exclusion chromatography
	5. Thin layer chromatography
	6. Cation exchange chromatography

(A) P-1, Q-4, R-3, S-5
(B) P-5, Q-3, R-6, S-1
(C) P-2, Q-4, R-3, S-5
(D) P-6, Q-5, R-2, S-4

40. In the two half reactions
Acetaldehyde + $2H^+ + 2e^- \rightarrow$ Ethanol $\quad \Delta E^\circ = -0.16\,V$
NADH + $H^+ \rightarrow NAD^+ + 2H^+ + 2e^-$ $\quad \Delta E^\circ = -0.32\,V$
(F = 23063 cal/V)
The ΔG° for coupled reaction will be (GATE XL 2010)

(A) +7,400 cal
(B) -7,400 cal
(C) -22,200 cal
(D) +22,200 cal

41. Match the parameters in Group 1 with the correct options in Group 2 (GATE XL 2010)

Group 1	**Group 2**
P. K_{cat}	1. Catalytic efficiency of the enzyme
Q. K_M	2. Affinity of enzyme to the inhibitor
R. K_I	3. Affinity of enzyme to the substrate
S. K_{cat}/K_M	4. Maximum buffering rate

(A) P-3, Q-1, R-2, S-4
(B) P-1, Q-2, R-3, S-4
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-4, R-2, S-3

42. The rise per residue of α-helix is about $1.5\,\mathring{A}$. A protein spans a $4nm$ bilayer 7 times through its transmembrane α-helical domain. Approximately, how many amino acid residues constitute the transmembrane domain of the protein (GATE XL 2010)

(A) 105 (B) 451 (C) 30 (D) 190

43. Match the proteins in Group 1 with their correct functions in Group 2 (GATE XL 2010)

Group 1	**Group 2**
P. Shaker protein	1. Inner membrane receptor
Q. Bacteriorhodopsin	2. Active transport
R. Porin	3. Voltage gated K^+ channel
S. ABC transporter	4. Light driven H^+ pump
	5. Membrane fusion
	6. β-barrel simple diffusion channel

(A) P-4, Q-2, R-3, S-5
(B) P-5, Q-3, R-4, S-6
(C) P-6, Q-1, R-5, S-4
(D) P-3, Q-4, R-6, S-2

44. The metabolic disorders, Alkaptonuria and Phenylketonuria are caused by defects in the enzymes (GATE XL 2010)

P Glucose 6-phosphatase
Q Phenylalanine hydroxylase
R Homogentisate 1,2-dioxygenase
S Tyrosinase

(A) Q, R
(B) P, R
(C) P, Q
(D) Q, S

45. Match the metabolic pathways in Group 1 with the corresponding enzymes in Group 2 (GATE XL 2010)

(A) P-4, Q-2, R-3, S-5
(B) P-3, Q-2, R-4, S-1
(C) P-3, Q-1, R-5, S-2
(D) P-4, Q-2, R-3, S-1

46. When changes in the phenotype or gene expression occur without changes in the underlying DNA sequence, the phenomenon is called (GATE XL 2010)

Group 1	Group 2
P. β-oxidation	1. Ribulose bisphosphate carboxylase
Q. Glycolysis	2. Phosphofructokinase 1
R. Gluconeogenesis	3. Phosphoenol pyruvate carboxykinase
S. Calvin cycle	4. Thiolase
	5. Phosphofructokinase 2

(A) Mutation
(B) Eugenics
(C) Epigenetics
(D) Epistasis

47. A population growing exponentially can be described by the differential equation $dN/dt = rN$, where dN/dt represents the rate at which the whole population grows, N is the size of the population, r is the intrinsic rate of increase, and t is time. According to this equation, the per capita rate of growth is (GATE XL 2010)

(A) Highest at large N
(B) Constant
(C) Lowest at large N
(D) Highest at small N

48. Which one of the following is NOT a plant hormone? (GATE XL 2010)

(A) Abscisic acid
(B) Brassinosteroid
(C) Ethylene
(D) Cytokine

49. *Arabidopsis* and rice have diploid chromosome numbers of 10 and 24, respectively. Assuming no crossing over taking place, genetic variation among F_2 individuals in a genetic cross is likely to be (GATE XL 2010)

(A) Same in both species but not zero
(B) More in *Arabidopsis*
(C) More in rice
(D) Zero in both species

50. Which of the following statements is CORRECT? (GATE XL 2010)
(A) Plants adapted to cold environment have higher ratio of "unsaturated to saturated" fatty acids in their membrane compared to those adapted to hot environment
(B) Plants adapted to cold environment have lower ratio of "unsaturated to saturated" fatty acids in their membrane compared to those adapted to hot environment
(C) Plants adapted to cold and hot environment have same ratio of "unsaturated to saturated" fatty acids in their membrane compared to those adapted to hot environment
(D) There are only saturated fatty acids in the membrane

51. A sign is hammered into a tree trunk 2 meters above the tree's base. If the tree is 10 meters tall and elongates 1 meter each year, how high will the sign be after 10 years? (GATE XL 2010)

(A) 12 meters
(B) 10 meters
(C) 4 meters
(D) 2 meters

52. In the arrangement of floral parts in a bud, identify the INCORRECT statement (GATE XL 2010)
(A) Valvate: where the petals or sepals do not overlap but simply touch one another by their margins
(B) Scarious: petals rough and harsh to touch
(C) Epicalyx: an extra whorl calyx found in some flowers outside the calyx
(D) Imbricate: where sepals and petals overlap each other at the margin

53. The possible genotypes of endosperms borne on a heterozygous (Rr) plant will be (GATE XL 2010)

(A) RRR, Rrr, Rrr, rr
(B) RRr, Rrr
(C) RR, Rr, rr
(D) Rr

54. The amount of chemical energy available to consumers in an ecosystem is best represented by (GATE XL 2010)

(A) Gross primary production
(B) Net primary production
(C) Respiration
(D) Photosynthesis

55. Free radical scavenging activity of a medicinally important plant extract can be quantified by (GATE XL 2010)
(A) ABTS (2,2′-azino-bis-(3-ethyl benzothiazoline-6-sulphonic acid)) method
(B) Bradford method
(C) Walkley and Black method
(D) Kjeldahl method

56. **Identify the CORRECT statements from the following** (GATE XL 2010)
P. Lenticels are the small pores present on the surface of the stem or branches of woody plants.
Q. Glyoxysomes contain chlorophyll molecules in their thylakoid membranes.
R. The enzyme ribulose 1,5 bisphosphate carboxylase is otherwise known as carboxydismutase.
S. 18 ATP and 12 NADPH molecules are utilized for fixing 6 molecules of CO_2 in the dark reaction of photosynthesis.

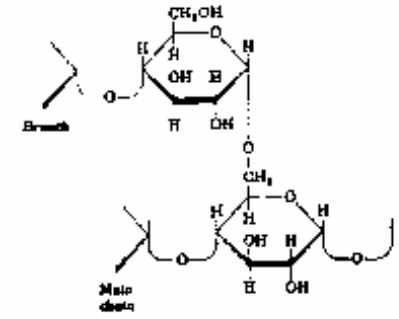
(A) P, Q
(B) P, R
(C) Q, R
(D) P, S

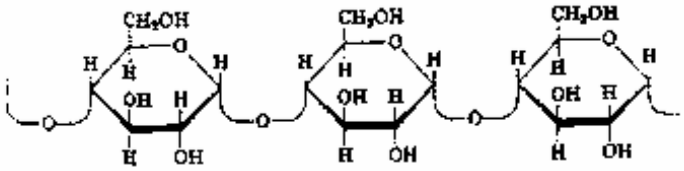
57. **Match the following** (GATE XL 2010)

Group I	**Group II**	**Group III**
P. Sorghum	1. Gossypol	i. Protein
Q. Castor	2. Strychnine	ii. Glycosidic conjugate
R. Mushroom	3. Durin	iii. Alkaloid
S. Cotton	4. Bungarotoxin	iv. Polyphenol
	5. Ricin	v. Lipid
	6. α-Amanitin	vi. Cyclic peptide

(A) P-3,i; Q-5,i; R-6,vi; S-1,iv
(B) P-2,ii; Q-4,iv; R-1,iii; S-6,v
(C) P-2,vi; Q-5,v; R-1,iv; S-6,i
(D) P-2,ii; Q-3,iii; R-4,iv; S-1,v

58. Name the structures given below in the order of their appearance and identify corresponding glycosidic linkages





(GATE XL 2010)

(A) Amylose, Cellulose; $\alpha(1 \rightarrow 4)$, $\beta(1 \rightarrow 6)$
(B) Cellulose, Dextran; $\beta(2 \rightarrow 4)$, $\alpha(3 \rightarrow 6)$
(C) Starch, Cellulose; $\alpha(1 \rightarrow 6)$, $\alpha(1 \rightarrow 4)$
(D) Amylopectin, Amylose; $\alpha(1 \rightarrow 6)$, $\alpha(1 \rightarrow 4)$

59. Identify the **CORRECT** statements
In *Arabidopsis*, vernalization is associated with
P. Chromatin modification at the *FLC* (*FLOWERINGLOCUSC*) locus
Q. Degradation of the FLC protein
R. Inactivating the FLC protein by post-translational modification
S. Down-regulation of *FLC* transcript (GATE XL 2010)

(A) Q, S
(B) P, S
(C) P, R
(D) Q, R

60. Which of the following statements in plant respiration are **CORRECT**?
P The oxidative Pentose Phosphate Pathway can accomplish the oxidation of glucose in the stroma of mitochondria

Q ATP is produced in the reaction step of TCA cycle catalyzed by succinyl CoA synthetase

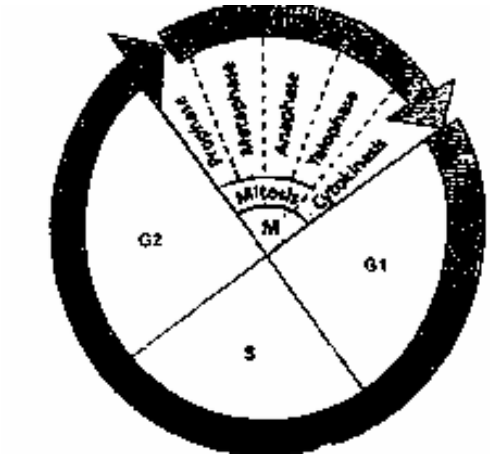
R In addition to Cytochrome c oxidase, an alternative oxidase enzyme resistant to cyanide reduces oxygen molecule in the electron transport system

S In Glyoxylate cycle acetyl CoA reacts with citrate to form α-keto glutarate

(GATE XL 2010)

(A) P, R
(B) P, Q
(C) Q, R
(D) Q, S

61. Study the following diagram depicting the plant cell cycle and match the following (GATE XL 2010)



(A) P-4, Q-3, R-1, S-2
(B) P-2, Q-3, R-1, S-4
(C) P-1, Q-4, R-3, S-2
(D) P-3, Q-1, R-2, S-4

Stages of cell cycle	Type of cyclin
P. Late G1-phase	1. Cyclin B
Q. Beginning of S-phase	2. Cyclin E
R. Prior to mitotic phase	3. S-Cyclin
S. Early G1-phase	4. Cyclin D

62. In the context of plant development, which of the following statements are **CORRECT**?
P Cell migration is absent

Q Apoptosis plays a major role

R Pattern formation continues throughout life

S Homeotic changes are caused by mutations in non-homeodomain proteins

(GATE XL 2010)

(A) P, Q, R
(B) Q, R, S
(C) P, Q, S
(D) P, R, S

63. Identify the correct match
Group I (**Anther**)

P Q

R S

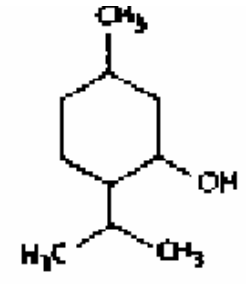
Group II (**Type of fixation**)
(A) Basifixed
(B) Longitudinal
(C) Dorsifixed
(D) Adenate
(E) Porous
(F) Versatile

(GATE XL 2010)

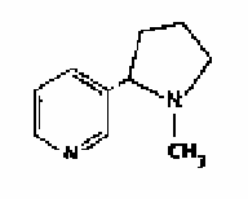
(A) P-1, Q-4, R-6, S-3 (B) P-2, Q-3, R-5, S-6 (C) P-1, Q-2, R-6, S-5 (D) P-4, Q-3, R-5, S-6

64. From the structures given below, identify the compounds

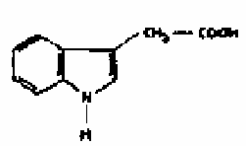
Group I (**Structure**)



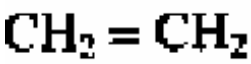
P



Q



R



S

Group II (**Compound**)

(A) Ethylene
(B) Indole butyric acid
(C) Nicotine
(D) Indole acetic acid
(E) Gibberellic acid
(F) Menthol

(GATE XL 2010)

(A) P-6, Q-3, R-4, S-1 (B) P-5, Q-2, R-3, S-1 (C) P-4, Q-3, R-2, S-6 (D) P-1, Q-2, R-5, S-6

65. Regarding the relationships between two organisms in an ecosystem, match the following

Group I (Relationship)	Group II (Definition)
P. Commensalism	1. Both organisms are benefited
Q. Mutualism	2. One impeding the success of the other
R. Parasitism	3. One organism benefits but the other is unaffected
S. Amensalism	4. One benefited, other is harmed

(GATE XL 2010)

(A) P-3, Q-2, R-4, S-1
(B) P-2, Q-3, R-4, S-1
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-4, R-3, S-2

66. An electron microscope has higher resolution as compared to the light microscope. This is because

(GATE XL 2010)

(A) the wavelength of an electron is longer than the wavelength of light
(B) the wavelength of an electron is shorter than the wavelength of light
(C) the electrons can penetrate the sample better
(D) they use different stains

67. Bacterial cell lysis by lysozyme is due to the

(GATE XL 2010)

(A) hydrolysis of $\alpha(1 \rightarrow 4)$-glycosidic bonds between the N-acetylglucosamine and N-acetylmuramic acid
(B) inhibition of cell wall synthesis
(C) hydrolysis of pentapeptide bridges

(D) hydrolysis of $\beta(1 \rightarrow 4)$-glycosidic bonds between the N-acetylglucosamine and N-acetylmuramic acid

68. The recombination frequencies between three genes x, y and z are as follows: x-y: 2.6%, y-z: 1.4% and x-z: 1.2%. Then the gene order is

(GATE XL 2010)

(A) x-y-z
(B) x-z-y
(C) y-x-z
(D) z-x-y

69. A mutant phenotype due to a nonsense mutation can be rescued by a mutation in tRNA gene. This rescue is an example of

(GATE XL 2010)

(A) induced mutation
(B) suppressor mutation
(C) spontaneous mutation
(D) deletion mutation

70. Ames test is performed to detect

(GATE XL 2010)

(A) mutagen
(B) pH
(C) nutrient stress
(D) salinity

71. Wild type E. coli forms purple colored colonies on EMB-lactose plate. This is due to

(GATE XL 2010)

(A) increase in pH of the medium
(B) decrease in pH of the medium
(C) secretion of purple colored pigment
(D) secretion of β-galactosidase

72. The resistance of a lambda lysogenic E. coli to re-infection by lambda is mediated by

(GATE XL 2010)

(A) blocking entry of the incoming lambda DNA
(B) degrading the incoming lambda DNA
(C) blocking transcription of the incoming lambda DNA
(D) triggering mutation of the lambda receptor of the host

73. Pasteurization of milk is carried out by

(GATE XL 2010)

(A) boiling for 5 min
(B) heating at 72°C for 30 min
(C) heating at 63°C for 15 min
(D) heating at 63°C for 30 min

74. A growing bacterial culture with a doubling time of 20 min reaches cell density of 2×10^8 cells/ml in 3 hours. How much time would it take to reach the cell density of 1×10^9 cells/ml?

(GATE XL 2010)

(A) 200 min
(B) 180 min
(C) 160 min
(D) 90 min

75. The quickest way to determine bacterial growth in terms of viable cells is through

(GATE XL 2010)

(A) Most probable number (MPN) technique
(B) Spread plate method
(C) Pour plate method
(D) Slide culture technique

76. Match the scientist from Group I with the corresponding contribution listed in Group II
(GATE XL 2010)

Group I: P. Robert Koch
Q. Walter Hesse
R. Louis Pasteur
S. Ferdinand Cohn
Group II: 1. Discovery of endospores
2. Disproved spontaneous generation
3. Discovery of causative agent of tuberculosis
4. Use of agar as solid media
5. Invention of microscope

(A) P-5, Q-1, R-3, S-2
(B) P-3, Q-4, R-1, S-5
(C) P-3, Q-4, R-2, S-5
(D) P-3, Q-4, R-2, S-1

77. Superantigens elicit a very strong T cell response because they
(GATE XL 2010)

(A) bind to the specific antigen binding site on the T cell receptors (TCR)
(B) bind to the site on T cell receptor (TCR) that is outside the antigen-specific binding site
(C) directly activate the T cell without the help of antigen presenting cells
(D) directly induce cytokine secretion by macrophages

78. MHC-I groove can be loaded with peptides of only 8–10 amino acids because
(GATE XL 2010)

(A) MHC-I groove is closed on both ends
(B) fragments of only 8–10 amino acids are generated in MHC-I bearing cells
(C) β_2-microglobulin of MHC-I prevents binding of large peptides to MHC-I
(D) pI of polypeptides of MHC-I prevents binding of 8–10 amino acid long peptides to MHC-I

79. In a *lacO*^{c} *lacIz*$^+$ / lacO$^+$ lacI*z*$^-$ partial diploid, of the two lacZ enzymes, only the mutant enzyme (*lacZ*$^-$) is synthesized constitutively. This observation shows that lacO^c mutation is
(GATE XL 2010)

(A) trans-dominant
(B) trans-recessive
(C) cis-dominant
(D) cis-recessive

80. Which one of the following events occurs in prokaryotes but NOT in eukaryotes?
(GATE XL 2010)

(A) Phosphorylation
(B) RNA polymerase and promoter interaction
(C) Control of transcription by attenuation
(D) Formation of Okazaki fragments

81. Match the pathogen in Group I with the corresponding disease in Group II

Group I	**Group II**
P. Bacteria	1. Measles
Q. Virus	2. Candidiasis
R. Fungi	3. Malaria
S. Protozoa	4. Tetanus
	5. Acute apicomplexan encephalitis
	6. Tuberculosis

(GATE XL 2010)

(A) (P-1, Q-2, R-4, S-5)
(B) (P-4, Q-6, R-2, S-3)
(C) (P-5, Q-1, R-6, S-2)
(D) (P-6, Q-1, R-2, S-3)

82. A bacterial culture was diluted 1000 fold and 0.1 ml of this diluted sample was spread per plate on nutrient agar. In a triplicate run, the number of colonies formed is 121, 93 and 86. The number of colony forming units/ml in the original bacterial culture is

(GATE XL 2010)

(A) 10^5 (B) 10^6 (C) 10^7 (D) 10^8

83. Match the microorganism in Group I with the application in Group II

Group I	**Group II**
P. Aspergillus oryzae	1. Metal ore leaching
Q. Brevibacterium flavum	2. Glucoamylase producer
R. Candida lipolytica	3. Biopesticide
S. Saccharomyces cerevisiae	4. Glutamic acid producer
T. Rhizobium meliloti	5. Penicillin producer
	6. Symbiotic nitrogen fixer

(GATE XL 2010)

(A) (P-1,Q-4,R-6,S-5,T-2)
(B) (P-1,Q-4,R-5,S-3,T-6)
(C) (P-2,Q-4,R-1,S-3,T-6)
(D) (P-6,Q-2,R-3,S-5,T-1)

84. A microbe is grown normally on glucose or on glycerol but not on acetate. The most likely metabolic pathway that is defective in the microbe is

(GATE XL 2010)

(A) (Glyoxalate cycle)
(B) (Hexose monophosphate shunt)
(C) (Kreb's cycle)
(D) (Entner-Doudoroff pathway)

85. Match the resistance mechanism in Group I with the antibiotic in Group II

Group I	**Group II**
P. β-Lactamases	1. Aminoglycosides
Q. Enhanced folate metabolism	2. Penicillins
R. Drug efflux	3. Sulfa drugs
S. Overproduction of the drug	4. Tetracyclines
T. Mutant RNA polymerase	5. Nalidixic acid
	6. Rifamycin

(GATE XL 2010)

(A) (P-1,Q-2,R-3,S-4,T-6)
(B) (P-2,Q-3,R-4,S-5,T-6)
(C) (P-2,Q-3,R-4,S-1,T-6)
(D) (P-1,Q-2,R-3,S-4,T-6)

86. From the perspective of developmental origin, which of the following structures is homologous to a tortoise shell?

(GATE XL 2010)

(A) Exoskeleton of a lobster
(B) Bones of a fish
(C) Skull of humans
(D) Feathers of birds

87. Acoelomates are characterized by

(GATE XL 2010)

(A) the absence of cavity surrounding the internal organs
(B) the presence of huge body cavity, as in case of terrestrial animals
(C) the presence of air sacs, as in case of birds
(D) the absence of brain in a group of extinct species

88. Identify the phylum that is characterized by the animals that have segmented appendages.

(GATE XL 2010)

(A) Cnideria (B) Porifera (C) Arthropoda (D) Mollusca

89. Which one of the following is the smallest biological unit capable of evolving over time?

(GATE XL 2010)

(A) A cell
(B) An individual organism
(C) A population
(D) A species

90. In case of parasites that require multiple hosts to complete their life cycle, what does definitive host mean?

(GATE XL 2010)

(A) It is the host that harbors the sexual stages of the parasite.
(B) It is the host in which the parasite reproduces asexually.
(C) It is the host in which the parasite feeds.
(D) It is the host in which the parasite remains in a dormant stage.

91. Enzymes catalyze biochemical reactions by

(GATE XL 2010)

(A) sequestering the product(s)
(B) decreasing the ΔG of the reaction
(C) increasing the ΔG of the reaction
(D) stabilizing the transition state of the reaction

92. Which one of the following results from Mendel's monohybrid cross is the strongest evidence against the blending theory?

(GATE XL 2010)

(A) 3 : 1 ratio of phenotypes in the F1 generation
(B) All progeny of the F1 generation exhibited the dominant phenotype
(C) The recessive phenotype showed up in the F2 progeny
(D) The observation of incomplete dominance

93. In the context of cell differentiation, lateral inhibition is referred to as the

(GATE XL 2010)

(A) formation of two distinct cell types within a uniform field
(B) inhibition of formation of a distinct cell type next to an existing cell type
(C) inhibition of stem cells towards self-renewal
(D) inhibition of erythropoiesis in the lateral plate mesoderm

94. As compared to peptide hormones, steroid hormones take more time to activate a cellular response because

(GATE XL 2010)

(A) steroid hormones show non-specific binding with diverse sets of receptors
(B) steroid hormone acts through a receptor which is a transcription factor
(C) cells that respond to steroid hormones are dormant in nature
(D) peptide hormones are not transported through plasma while steroid hormones are

95. In allopatric mode of speciation, a new species forms due to

(GATE XL 2010)

(A) Geographic isolation
(B) Genetic drift
(C) Formation of a few fertile individuals that can not mate with other members of the same species living in the same geographical area
(D) The formation of allopolyploid condition

96. Neurogen (Ngn) a newly discovered protein in chicken, is produced by the notochord and the floor plate (FP). Ngn induces cells of the neural tube (NT) to become neurons. It is known that from ventral to dorsal direction cells at different levels give rise to distinct types of neuronal cells. Which of the following observations will cast a doubt in the claim that Ngn is a morphogen?

(GATE XL 2010)

(A) Ngn is a cytosolic protein
(B) Artificial mis-expression of Ngn at identical level through out NT does not affect the neuronal cell types formed in the NT
(C) Ngn is an integral membrane protein
(D) All of the above

97. An alien species has been discovered with very similar genetic makeup as that of the existing species on planet earth with certain differences. The genetic material of this new species is referred to as DNA*. The building blocks of the genetic material is known as Nucleotide*. The proteins of the new species (Protein*) is made up of Amino Acids*.

It has also been discovered that the new species has 5 distinct Nucleotide* as opposed to the four for species on planet earth. The new species has 40 different Amino Acids* as opposed to the 20 for species of planet earth. What should be the codon length for this new species (the same for species of planet earth is 3)? It may be assumed that the average codon degeneracy of the new species is very similar to that of species of planet earth.

(GATE XL 2010)

(A) 2 (B) 3 (C) 4 (D) 5

98. Which one of the following options is NOT a viable strategy for developing a female contraceptive() The administration of

(GATE XL 2010)

(A) a combination of synthetic progesterone and estrogen
(B) synthetic progesterone alone
(C) ormeloxifene - a selective estrogen receptor modulator

(D) a synthetic oxytocin

99. In the field of community ecology, the term (competitive exclusion) refers to two species that cannot co-exist

(GATE XL 2010)

(A) in a community if the niches are identical
(B) in two different communities if the niches are identical
(C) if the ecosystem is imbalanced
(D) in the event of a volcanic eruption

100. During immune response, more potent humoral immunity against the antigen appears earlier than the primary response. Which one of the following is the primary reason for this phenomenon?

(GATE XL 2010)

(A) Affinity of antibody molecules produced by B cells is weaker than that of T cells.
(B) Memory cells have a longer life span than that of T cells.
(C) B-cell activation requires helper T cells.
(D) Thymus selection more rapidly enhances the T cell population than B cell population.

101. Oceans have enormous impact on the biosphere. Identify which one of the following factors is NOT influenced by the marine biome.

(GATE XL 2010)

(A) CO_2 level in the atmosphere.
(B) Global air temperature and wind patterns.
(C) pH of the fresh water bodies.
(D) Oxygen level in the biosphere.

102. Certain lung fishes that live in small stagnant fresh water pools produce urea as a nitrogenous waste. What is the advantage of this adaptation?

(GATE XL 2010)

(A) Urea forms precipitates and does not accumulate in the surrounding water.
(B) Lung fish do not find enough water for production of ammonia and hence the nitrogenous waste is converted to urea.
(C) The surrounding water makes the pool uninhabitable to the predators of the lung fish.
(D) Urea requires much less energy for its synthesis than ammonia.

103. Hamilton's rule measures the probability of whether or not natural selection would favor an altruistic act. Which one of the following statements best explains Hamilton's rule. Natural selection would favor an altruistic act only when

(GATE XL 2010)

(A) the receiver and not the altruist is benefited.
(B) the benefit to the receiver is higher than the cost of the altruist.
(C) the benefit to the receiver, reduced by the coefficient of relatedness, exceeds the cost to the altruist.
(D) the altruist survives in an altruistic act to save his/her related individuals.

104. In a cross between plants with purple- and white-colored flowers, the following results were obtained in the F_2 generation from a single test cross. The numbers of different colored flowers were 900 purple, 300 lilac, 400 white; 150 yellow, 200 blue, 245 greenish yellow, 300 green; and light blue; 400 red, 200 indigo, 253 purple; and 198 dark purple. These data support which one of the following conclusions.

(GATE XL 2010)

(A) Flower color in this species does not follow Mendelian inheritance.
(B) It is a polygenic inheritance.
(C) Colors are co-dominant in this species.
(D) Flower color in this species is determined by multiple genes.

105. Which one of the following is most crucial for the success of vaccination?

(GATE XL 2010)

(A) Antigen presentation by T-helper cells.
(B) Complement system.
(C) Presence of long-lived antigen specific lymphocytes.
(D) Phagocytosis of the cells in the lymphoid tissue.