

B.S. ABDUR RAHMAN UNIVERSITY, CHENNAI – 600 048

PHD ENTRANCE EXAMINATION

Branch : **Life Sciences** Date & Session : **16/06/2016**
Time : **2 hours** Maximum Marks : **100**

1. The secondary structure in protein is primarily maintained by
 - a. Van der waals force
 - b. Hydrogen bond
 - c. Peptide bond
 - d. Hydrophobic bond
2. The amyloid protein deposition associated with Alzheimer's disease is composed of
 - a. Alpha helix
 - b. Beta pleated sheets
 - c. Beta bends
 - d. Loops
3. The primary structure in protein is primarily maintained by
 - a. Ionic bond
 - b. Peptide bond
 - c. Hydrogen bond
 - d. Van der waals force
4. Which of the following is a sequence alignment tool
 - a. BLAST
 - b. PDB
 - c. PROSITE
 - d. PIR
5. Which of the following amino acids is most compatible with alpha helical structure?
 - a. Proline
 - b. Alanine
 - c. Glycine
 - d. Lysine
6. Clustal W is a
 - a. Multiple Sequence Alignment Tool
 - b. Protein Secondary Structure Prediction Tool
 - c. Data retrieving tool
 - d. Nucleic Acid Sequence Analysis Tool
7. Which of the following are components of Central Processing Unit (CPU) ?
 - a. Arithmetic logic unit, Mouse
 - b. Arithmetic logic unit, Control unit
 - c. Arithmetic logic unit, Integrated Circuits
 - d. Control Unit, Monitor

8. is the layer of a computer system between the hardware and the user program
- Operating environment
 - Operating system
 - System environment
 - Boot up program
9. If a computer provides database services to other, then it will be known as?
- Web Server
 - Application Server
 - Database Server
 - FTP Server
10. What are the major differences between northern and Southern blots?
- Northern Blots do not require restriction endonucleases, but the substance being studied must be denatured in heated formaldehyde, instead of SDS
 - Southern Blots do not require restriction endonucleases, but the substance being studied must be denatured in heated formaldehyde, instead of SDS.
 - Northern Blots require restriction endonucleases, and the substance being studied must be denatured in heated formaldehyde, instead of SDS.
 - Southern Blots require restriction endonucleases, and the substance being studied must be denatured in heated formaldehyde, instead of SDS.
11. Which is the correct order for steps to be taken in a Southern Blot? I. Detect specific fragments by hybridizing DNA probe (radioactive or non-radioactive) to DNA on membrane. II. Denature dsDNA in gel using NaOH (high pH). III. Digest DNA with restriction enzyme. IV. Visualize hybridized bands with P-imager or film. V. Transfer ("blot") ssDNA from gel to membrane. VI. Size fractionate DNA fragments in agarose gel and stain with EtBr to visualize all DNA.
- III, VI, II, V, I, IV
 - II, IV, V, VI, III, I
 - IV, I, V, II, VI, III
 - III, I, V, VI, II, IV
12. Guanine specific cleavage in Maxam-Gilbert method is done by using
- Formic acid
 - Hydrazine
 - Dimethyl sulphate
 - Piperidine
13. The principle of Sanger's method relies on
- Use of chemicals for base specific cleavage
 - Use of dNTPs for chain termination
 - Use of ddNTPs for chain termination
 - Use of ^{32}P chain termination
14. Sulphur containing amino acids are
- Methionine and threonine

- b. Cysteine and Threonine
 - c. Cysteine and Methionine
 - d. Cysteine and Serine
15. Absorbance at 280nm exhibited by protein is due to
- a. Serine
 - b. Cysteine
 - c. Tryptophan
 - d. Histidine
16. Which of the statement is true regarding K_m
- a. It is the measure of the stability of the ES complex
 - b. It is the measure of the stability of the affinity of an enzyme for its substrate
 - c. A high K_m indicates weak substrate binding
 - d. All of these
17. Succinate is the substrate for succinate dehydrogenase that converts succinate to fumarate. In the presence of reversible competitive inhibitor like malonate in place of succinate, the enzyme's
- a. K_m increases and V_{max} remains the same
 - b. Both K_m and V_{max} increases
 - c. Both K_m and V_{max} decreases
 - d. K_m decreases and V_{max} remains the same
18. A reversible non-competitive inhibitor binds reversibly at a site other than the active site. This binding leads to
- a. Increase in K_m and V_{max} remains constant
 - b. Increase in V_{max} and K_m remains constant
 - c. Decrease in V_{max} and K_m remains constant
 - d. No change in V_{max} and K_m .
19. The effect of a reversible competitive inhibitor can be nullified by
- a. Increasing the product concentration
 - b. Increasing the substrate concentration
 - c. Increasing the temperature
 - d. All of these
20. Which of the following is not true of transition-state analogues
- a. They mimic the transition state of an enzyme-catalysed reaction
 - b. They react irreversibly with the enzyme
 - c. They are bound more strongly than the substrate or the product
 - d. They require the presence of a stable functional group to mimic the functionality present in the transition state.
21. Which of the following agents act as irreversible inhibitors ?
- a. Sulphonamides
 - b. Penicillins
 - c. Statins
 - d. Protease inhibitors

22. Which of the following drugs can be classed as a suicide substrate?
- Orlistat
 - 6-Mercaptopurine
 - Aliskiren
 - Clavulanic acid
23. A process in which 2 molecules of pyruvate and a gain of 2 molecules of ATP occurs in:
- Citric acid cycle
 - Glycolysis
 - Gluconeogenesis
 - Oxidative phosphorylation
24. When muscles contract, chemical energy is converted to mechanical energy with the loss of heat. This is an example of the _____ law of thermodynamics.
- Zeroth
 - First
 - Second
 - Third
25. The energy that is released from ATP when ATP is broken down comes from the
- Ribose sugar
 - Hexose sugar
 - Phosphate group
 - Adenine group
26. Which of the following is considered a vitamin?
- FAD
 - NAD⁺
 - Thiamine pyrophosphate
 - Niacin
27. A coal mine worker was brought in an unconscious state to emergency room after a blast in the mine. His blood carboxy hemoglobin level was high and he was diagnosed with CO poisoning. CO is a known inhibitor of electron transport chain. Which complex of electron transport chain is inhibited by CO?
- Complex I
 - Complex II
 - Complex III
 - Complex IV
28. The drug fluorouracil is recommended for the treatment of cancers. It undergoes a series of changes and then binds to thymidylate synthase enzyme resulting in its inhibition and blockage of cell division. This mode of inhibition is most probably due to
- Allosteric Inhibition
 - Competitive Inhibition
 - Noncompetitive Inhibition
 - Suicidal Inhibition

29. The activities of many enzymes, membrane transporters and other proteins can be quickly activated or inactivated by phosphorylation of specific amino acid residues. This regulation is called
- Allosteric modification
 - Covalent modification
 - Induction
 - Repression
30. A recently diagnosed hypertensive patient has been prescribed an ACE inhibitor which is known to act by lowering V max, what is the possible mechanism of inhibition of this drug?
- Competitive
 - Non Competitive
 - Uncompetitive
 - None of the above.
31. A 23-year-old woman is seen for a lump in her breast that she palpated on self breast examination. History reveals that her mother and her aunt both had breast and ovarian cancer. Given this presentation, you suspect the patient may have a mutation in which of the following genes involved in DNA repair ?
- BRCA-1
 - ras
 - bcl-2
 - p53
32. A 78 year old male was brought to emergency with difficulty in passing urine and weight loss. The attending urologist suspected carcinoma prostate. Which of the following molecular marker would help in the confirmation of diagnosis?
- Carcino embryonic antigen (CEA)
 - Alpha fetoprotein (AFP)
 - Tissue specific antigen
 - Acid phosphatase
33. As electrons are received and passed down the transport chain, the electron carriers are first reduced with the acceptance of the electron and then oxidized with loss of the electron. A patient poisoned by which of the following compounds has the most highly reduced state of most of the respiratory chain carriers?
- Rotenone
 - Carbon monoxide
 - Puromycin
 - Nitrous oxide
34. If the oxidative phosphorylation was uncoupled in the mitochondria, what would one expect?
- A decreased concentration of ADP in the mitochondria
 - Increased inorganic phosphate in the mitochondria
 - A decreased oxidative rate
 - Increased transport of ADP from the cytosol to the mitochondrial matrix.
35. In substrate level phosphorylation

- a. The substrate reacts to form a product containing a high energy bond
 - b. ATP synthesis is linked to dissipation of proton gradient
 - c. High energy intermediate compounds cannot be isolated
 - d. Only mitochondrial reactions participate in ATP formation.
36. An 18-year-old college student is brought to the emergency room unconscious, with a very high serum alcohol level. Alcohol metabolism can result in high NADH levels. When NADH enters the electron transport chain, which of the following is the correct order in which electron transfer occurs ?
- a. NADH, coenzyme Q, cytochrome c, FMN, O₂
 - b. NADH, cytochrome c, coenzyme Q, FMN, O₂
 - c. NADH, FMN, coenzyme Q, cytochrome c, O₂
 - d. NADH, FMN, cytochrome c, coenzyme Q, O₂
37. The free energy released during the transport of a pair of electrons in electron transport chain is
- a. 7.3 Kcal / mol
 - b. 52.6 Kcal/mol
 - c. 21.9 Kcal/mol
 - d. None of the above.
38. Systemic lupus erythematosus is an auto immune disorder that results due to the formation of antibodies against snRNPs. What is the function of snRNPs ?
- a. Attachment of poly A tail
 - b. Splicing
 - c. 5' capping in mRNA
 - d. Base modification
39. The promoter region in prokaryotic transcription is recognized by
- a. DNA binding regions
 - b. Sigma factor of RNA polymerase
 - c. Rho factor
 - d. Beta subunit of RNA polymerase
40. Chargaff's rule states that in a double stranded DNA molecule
- a. Concentration of Deoxyadenosine (A) equal that of Thymidine (T) nucleotides
 - b. Concentration of Deoxyadenosine (A) equals that of Deoxyguanosine (G) nucleotides
 - c. Concentration of Deoxycytidine (C) equals that of Thymidine (T) nucleotides.
 - d. Concentration of Deoxy uridine (U) equals that of DeoxyGuanosine (G) nucleotides
41. When the B DNA is slightly dehydrated in the laboratory it takes on
- a. Negative Supercoils
 - b. Positive Supercoils
 - c. Z conformation
 - d. A conformation
42. Protein-coding genes can be identified by
- a. Transposon tagging

- b. ORF scanning
 - c. Zoo-blotting
 - d. Nuclease S1 mapping
43. The function of genes can be determined by
- a. Homology search
 - b. Exon trapping
 - c. Zoo-blotting
 - d. Northern Analysis
44. Microarrays
- a. Are used for analysis of transcriptomes
 - b. Are made of glass
 - c. Contain RNA sequences
 - d. Are smaller than DNA chips
45. Expression of genes can be analyzed by
- a. Northern analysis
 - b. Southern analysis
 - c. Comparative genomics
 - d. RNA interference
46. cDNA is made from
- a. mRNA
 - b. rRNA
 - c. DNA
 - d. Plasmids
47. The DNA microarrays technology that tracks deletions and amplifications of specific DNA sequences is called
- a. DNA variation screening
 - b. Gene expression profiling
 - c. Microarray comparative genomic hybridization
 - d. Antisense
48. Which of these conclusions might be drawn from the results of a 2D gel electrophoresis experiment ?
- a. Levels of mRNA expression for two different genes are lower under one set of conditions than another.
 - b. In a mutant cell, the lack of protein expression is due to production of unstable mRNA, which is rapidly degraded.
 - c. A mutation prevents proper posttranslational modification of a protein.
 - d. None of these are reasonable conclusions.
49. Why might you want to search a database for a protein motif?
- a. A specific motif may impart a specific function to the molecule. You could then identify groups of proteins that may have similar functions.
 - b. Presence of a specific motif in several proteins indicates that they are likely to be all from the same species

- c. Absence of a specific motif from one of a pair of otherwise similar proteins indicates that they are produced by alternative splicing of the same gene.
 - d. All of the above.
50. Homologous genes
- a. Would be expected to have very similar sequences in related organisms.
 - b. Would be expected to be more similar in distantly related organisms than in organisms that are closely related
 - c. May have become similar to each other by random mutation.
 - d. All of these.
51. A good way to increase total proteome penetration by gel-free LC-MS/MS methods is to
- a. Use two, orthogonal types of chromatography
 - b. Enrich for phosphopeptides only
 - c. Analyze whole proteins
 - d. Label the proteins with a chemical tag.
52. If your quantitative proteomics experiment contains a large number of samples, which of these would be a good method to choose?
- a. iTRAQ
 - b. SILAC
 - c. Label-free quantification
 - d. Western blotting
53. Selected reaction monitoring is useful for which of the following?
- a. Comparing the levels of hundreds or thousands of proteins
 - b. Comparing the levels of a specific protein
 - c. Identifying a protein in a gel band/spot
 - d. Identifying the position of an unknown post-translational modification
54. When quantifying proteins from an MS experiment, how do you work out what level a change is likely to be due to biology, and not experimental or technical variation?
- a. Use 2-fold as a generic cut-off
 - b. Use pathway analysis software
 - c. Look in the literature to see what other people use
 - d. Analyze replicates to measure experimental noise.
55. Which one of the following reactions is used for the purpose of recycling enzymes in bioprocesses ?
- a. Isomerization
 - b. Polymerization
 - c. Phosphorylation
 - d. Immobilization
56. In large scale fermentation, the preferred method of sterilization is
- a. Chemicals
 - b. Filtration
 - c. Radiation
 - d. Heat

57. For scaling up a bioreactor, the following parameter is assumed to be constant
- Airflow rate
 - Diameter of the impeller
 - Agitator speed
 - Volumetric mass transfer coefficient
58. If the fractional recovery at each step of unit operation is 0.8, the recovery after 4 step will be
- 0.24
 - 3.23
 - 0.41
 - 0.82
59. Power number, also Newton's number is defined as a dimensionless parameter relating to
- Turbulent flow
 - The relative velocity between the nutrient solution and individual cells
 - Energy required by the stirred reactors
 - None of the above.
60. Which of the following techniques is not ideal for immobilizing cell-free enzymes?
- Physical entrapment by encapsulation
 - Covalent chemical bonding to surface carriers
 - Physical bonding by flocculation
 - Covalent chemical bonding by cross linking the precipitate.
61. If three unbiased coins are tossed, what is the probability of getting at least 2 tails?
- $1/3$
 - $1/6$
 - $1/2$
 - $1/8$
62. Two dice are thrown simultaneously. What is the probability of getting two numbers whose product is even?
- $3/4$
 - $1/4$
 - $7/4$
 - $1/2$
63. If $\log_x 4 = 1/4$, then x is equal to
- 16
 - 64
 - 256
 - 128
64. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio should these be mixed to get an alloy 15 times as heavy as water?
- 3:2
 - 1:1
 - 2:3
 - 1:2

65. A pupil's marks were wrongly entered as 83 instead of 63. Due to that the average marks for the class got increased by half. The number of pupils in the class is:
- 20
 - 40
 - 10
 - 73
66. The population of a new city is 5 million and is growing at 20% annually. How many years would it take to double at this growth rate?
- 3-4 years
 - 4-5 years
 - 5-6 years
 - 6-7 years
67. 10% of the population in a town is HIV+. A new diagnostic kit for HIV detection is available; this kit correctly identifies HIV+ individuals 95% of the time, and HIV- individuals 89% of the time. A particular patient is tested using this kit and is found to be positive. The probability that the individual is actually positive is _____
- 0.89
 - 0.49
 - 1.2
 - 0.001
68. The unit for specific substrate consumption rate in a growing culture is
- $g / (L - h)$
 - g / h
 - $g / (g - h)$
 - $gmoles / (L - h)$
69. If the dissociation constant for solute-adsorbent binding is K_D , the retention time of the solute in a chromatography column
- Increases with increasing K_D
 - Decreases with increasing K_D
 - Passes through minimum with increasing K_D
 - Is independent of K_D
70. In a batch culture of *Penicillium chrysogenum*, the maximum penicillin synthesis occurs during the
- Lag phase
 - Exponential phase
 - Stationary phase
 - Death phase
71. The most plausible explanation for a sudden increase of the respiratory quotient (RQ) of a microbial culture is that
- Cells are dying
 - Yield of Biomass is increasing
 - The fermentation rate is increasing relative to respiration rate
 - The maintenance rate is decreasing

72. Since mammalian cells are sensitive to shear, scale-up of a mammalian cell process must consider, among other parameters, the following (given N = rotations/time, D =diameter of impeller)
- πND
 - $\pi N^2 D$
 - πND^2
 - πND^3
73. The product(s) resulting from the hydrolysis of maltose is/are
- a mixture of α - D -Glucose and β - D -Glucose
 - a mixture of D-Glucose and L-Glucose
 - α - D -Glucose only
 - β - D -Glucose only
74. Prior exposure of plants to pathogens is known to increase resistance to future pathogen attacks. This phenomenon is known as
- systemic acquired resistance
 - hypersensitive response
 - innate immunity
 - antibody mediated response
75. Which one of the following is an ABC transporter?
- multidrug resistance protein
 - acetylcholine receptor
 - bacteriorhodopsin
 - ATP synthase
76. Hypophosphatemia is manifested by an X-linked dominant allele. What proportion of the offsprings from a normal male and an affected heterozygous female will manifest the disease?
- $\frac{1}{2}$ sons and $\frac{1}{2}$ daughters
 - all daughters and no sons
 - all sons and no daughters
 - $\frac{1}{4}$ daughters and $\frac{1}{4}$ sons
77. The statistical frequency of the occurrence of a particular restriction enzyme cleavage site that is 6 bases long can be estimated to be
- once every 24 bases
 - once every 256 bases
 - once every 1024 bases
 - once every 4096 bases
78. AT-flask is seeded with 10^5 anchorage-dependent cells. The available area of the T-flask is 25cm^2 and the volume of the medium is 25ml. Assume that the cells are rectangles of size $5\ \mu\text{m} \times 2\ \mu\text{m}$. If the cells grow to monolayer confluence after 50 h, the growth rate in number of cells ($\text{cm}^2 \cdot \text{h}$) is _____ $\times 10^5$
- 5
 - 2
 - 4

d. 0.1

79. Triose phosphate isomerase converts dihydroxy acetone phosphate (DHAP) to glyceraldehyde-3-phosphate (G-3-P) in a reversible reaction. At 298 K and pH 7.0, the equilibrium mixture contains 40 mM DHAP and 4 mM G-3-P. Assume that the reaction started with 44 mM DHAP and no G-3-P. The standard free-energy change in kJ/mol for the formation of G-3-P [$R = 8.315 \text{ J/mol.K}$] is _____
- 6.5
 - 2.5
 - 5.2
 - 10
80. Consider a population of 10,000 individuals, of which 2500 are homozygotes (PP) and 3000 are heterozygotes (Pp) genotype. The frequency of allele p in the population is _____.
- 0.3
 - 0.9
 - 0.6
 - 0.1
81. Which one of the following features is not required in a prokaryotic expression vector
- oriC
 - Selection marker
 - CMV promoter
 - Ribosome binding site
82. Majority of ATPs (30 molecules) are generated within the cell by
- Glycolysis
 - Citric acid cycle
 - Electron-transport chain
 - Gluconeogenesis
83. T cells acquire T cell receptor in
- spleen
 - bone marrow
 - thymus
 - lymph node
84. CD4+CD25+ is a marker for
- Helper T-cells
 - Cytotoxic T-cells
 - An activated macrophage
 - Regulatory T cells
85. Antigen-presenting cells are
- dendritic cells, macrophages, and B lymphocyte
 - dendritic cells and macrophages
 - macrophages and B lymphocyte
 - B lymphocyte

86. An example of a known oncogenic virus is:
- Herpes zoster.
 - HIV-2.
 - Epstein-Barr virus.
 - Vesicular stomatitis virus
87. Tears and saliva contain
- IgA
 - IgG
 - lysozyme
 - IgD
88. Which one type of cells is known to be involved in the initial line of defense?
- Macrophages
 - Neutrophils
 - B lymphocyte
 - T lymphocyte
89. Which of the following describes the concept of "induced fit"?
- Substrate binding may induce a conformational change in the enzyme, which then brings catalytic groups into proper orientation.
 - Enzyme-substrate binding induces an increase in the reaction entropy, thereby catalyzing the reaction.
 - Enzyme specificity is induced by enzyme-substrate binding.
 - Enzyme-substrate binding induces movement along the reaction coordinate to the transition state
90. What will happen to an exothermic reaction if temperature is increased?
- Rate of reaction decrease
 - Rate of reaction increase
 - Reaction equilibrium shifts forward
 - Reaction equilibrium shifts backward
91. The process common to aerobic and anaerobic respiration is _____.
- Oxidation
 - Glycolysis
 - Krebs Cycle
 - Electron Transport chain
92. During the replication of DNA, the synthesis of DNA on lagging strand takes place in segments, these segments are called
- Satellite segments
 - Double-helix segments
 - Kornberg segments
 - Okazaki segments
93. Mode of DNA replication in *E. coli* is

- a) Conservative and unidirectional
 - b) Semiconservative and unidirectional
 - c) Conservative and Bidirectional
 - d) Semiconservative and Bidirectional
94. During process development, a common use for bioprocess simulation is for
- a) Process mapping and cost analysis
 - b) Plant layout
 - c) instrumental analysis
 - d) equipment installation
95. Addition of SCN^- to protein solution causes
- a) salting in
 - b) salting out
 - c) aggregation
 - d) no effect
96. Specific activity is the
- a) ratio of total activity to total protein
 - b) ratio of total protein to activity
 - c) ratio of the biomass to the protein concentration
 - c) ratio of biomass to the product activity to substrate activity
97. Aerobic industrial microbial processes, one of the most difficult problems to solve is
- a) maintaining an adequate energy source
 - b) adjusting the pH to a desired value and maintaining that value
 - c) providing adequate aeration
 - d) homogenous mixing
98. Sterilization by discontinuous heating is called as
- a) pasteurization
 - b) autoclaving
 - c) tyndallization
 - d) filter aided sterilization
99. Biological films are the multilayer growth on
- a) cells on the nutrient liquid medium
 - b) cells on solid support surfaces
 - c) cells on inert inactive materials
 - d) cells on biologically inactive surfaces
100. In bubble column bioreactor, the agitation is done by
- a) liquid circulation
 - b) mechanical pump
 - c) gas sparging
 - d) up and down circulation

Answer Key

- | | | |
|-------|-------|--------|
| 1) B | 49) A | 97) C |
| 2) B | 50) A | 98) C |
| 3) B | 51) A | 99) B |
| 4) A | 52) C | 100) C |
| 5) B | 53) B | |
| 6) A | 54) D | |
| 7) B | 55) D | |
| 8) B | 56) D | |
| 9) C | 57) D | |
| 10) B | 58) B | |
| 11) A | 59) C | |
| 12) D | 60) C | |
| 13) C | 61) C | |
| 14) C | 62) A | |
| 15) C | 63) C | |
| 16) D | 64) A | |
| 17) A | 65) B | |
| 18) C | 66) A | |
| 19) B | 67) B | |
| 20) B | 68) C | |
| 21) B | 69) B | |
| 22) D | 70) C | |
| 23) B | 71) C | |
| 24) C | 72) A | |
| 25) C | 73) A | |
| 26) D | 74) A | |
| 27) D | 75) A | |
| 28) D | 76) A | |
| 29) B | 77) D | |
| 30) A | 78) B | |
| 31) A | 79) B | |
| 32) D | 80) C | |
| 33) B | 81) C | |
| 34) B | 82) C | |
| 35) A | 83) C | |
| 36) C | 84) D | |
| 37) B | 85) A | |
| 38) B | 86) C | |
| 39) B | 87) C | |
| 40) A | 88) A | |
| 41) D | 89) A | |
| 42) B | 90) D | |
| 43) A | 91) B | |
| 44) A | 92) D | |
| 45) A | 93) D | |
| 46) A | 94) A | |
| 47) C | 95) A | |
| 48) D | 96) A | |

