

Hall Ticket No.

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Entrance Examinations – 2016
M.Sc. Biochemistry

Booklet Code : C

Time : 2 hours

Max. Marks : 100

Please read the following instructions carefully before answering:

1. Enter Hall Ticket number in the space provided above and also on OMR sheet.
2. Paper contains three sections: Part A, Part B and Part C together with 85 questions for 100 marks. **Part A contains 25 questions, each question carries one mark. Part B contains 45 questions, each question carries one mark. Part C contains 15 questions, each question carries two marks.**
3. **Part A will be used for tie breaking.**
4. **In Part A there is negative marking. 0.33 marks will be deducted for each wrong answer. In Part B there is no negative marking. In Part C there is negative marking. 0.66 marks will be deducted for each wrong answer.**
5. Answers have to be marked on the OMR sheet as per the instructions provided.
6. Apart from OMR sheet, the question paper contains 14 (Fourteen) pages including the instructions.
7. **Please return the OMR answer sheet at the end of examination.**
8. No additional sheet will be provided.
9. Rough work can be carried out in the question paper itself in the space provided at the end of the booklet.
10. Non programmable calculators are allowed.

PART A

[Each Question has only one right answer. Mark the right answer]

1. When two heterozygous individuals are mated, the percent of heterozygous offsprings will be
a) 0 b) 50 c) 25 d) 100
2. The following receptor (type) mediates odorants and bitter taste signals:
a) G-protein coupled receptors b) EGFR
c) Nuclear receptors d) Receptors with tyrosine kinase activity
3. In dicotyledonous leaves, stomata are arranged in
a) Linear rows b) Parallel manner
c) Scattered d) Radially
4. Coir is made from which part of the coconut?
a) Epicarp b) Seedcarp
c) Mesocarp d) Pericarp
5. Which one of the following statements is **not true**?

- a) Rate of facilitated transport is saturable
 - b) Facilitated transport is specific with respect to the type of molecules transported
 - c) Rate of transport by simple diffusion is saturable
 - d) Active transport can take place against concentration gradient
6. Transfer of DNA from donor to recipient by a bacteriophage is
- a) Transformation
 - b) Transduction
 - c) Conjugation
 - d) Transposition
7. Coliform bacteria are used as indicators of sewage pollution because they:
- a) Are non-pathogenic
 - b) Survive best in sewage
 - c) Are abundant in human intestine
 - d) Are easy to culture
8. Lichens are combinations of green algae and fungi. They exist in a ----- relationship
- a) Opportunistic
 - b) Commensal
 - c) Mutualistic
 - d) Parasitic
9. Carpel, the female reproductive part of a flower consists of all these parts **except**:
- a) Stigma
 - b) Ovary
 - c) Style
 - d) Calyx
10. Which of the following blood cell types is NOT in the same group as others?
- a) Lymphocyte
 - b) Eosinophil
 - c) Neutrophils
 - d) Basophil
11. Leeches feed on blood for which their saliva contains an anticoagulant. Which of the following is secreted by leeches in their saliva?
- a) Heparin
 - b) Hirudin
 - c) Hematin
 - d) Hemoglobin
12. The portion of the nervous system that is responsible for the bodily functions without any conscious directions, such as breathing, heartbeat, and digestive processes etc are called:
- a) Somatic nervous system
 - b) Sensory nervous system
 - c) Autonomic nervous system
 - d) Motor nervous system
13. Oleic acid has which of the following functional groups?
- a) Carboxylic acid, alcohol
 - b) Alkene, carboxylic acid
 - c) Alkene, alcohol and carboxylic acid
 - d) Alkene and alcohol
14. Deamination of cytosine leads to the formation of
- a) Thymine
 - b) Uridine
 - c) 5-Methylcytosine
 - d) Uracil
15. When 150 g of urea (MW 60) was dissolved in 1.35 kg of water it gave a solution of density 1.2 g/mL. What would be the molarity (M) of the solution?
- a) 1.85
 - b) 2.22
 - c) 1.54
 - d) 2.00
16. Which of the following proteins is an ATPase in the skeletal muscle?
- a) Actin
 - b) Myosin
 - c) Troponin
 - d) Tropomyosin

17. Which of the following characteristics best defines gymnosperms:
- a) Exposed seeds, vascular, unisexual flowers
 - b) Exposed seeds, bisexual flowers, haploid endosperm
 - c) Vascular, triploid endosperm, flat leaves
 - d) Cone like leaves, triploid endosperm, hard wood producing
18. The major site of regulation of glycolysis is with
- a) Pyruvate kinase
 - b) Phosphofructokinase
 - c) Hexokinase
 - d) Aldolase
19. Starch is best defined as
- a) Polysaccharide of glucose and galactose in 1,6-glycosidic linkage
 - b) Polysaccharide of glucose in 1,4 and 1,6-glycosidic linkage
 - c) Polysaccharide exclusively of glucose in 1,4-alpha glycosidic linkage
 - d) Polysaccharide of galactose in 1,4-glycosidic linkage
20. The cause of disease scurvy is due to the deficiency of
- a) Vitamin B6
 - b) Ascorbic acid
 - c) Niacin
 - d) Pantothenic acid
21. What is concentration of H^+ ion in a solution of 0.1 M NaOH?
- a) 10^{-13} M
 - b) 10^{-10} M
 - c) 10^{-7} M
 - d) 10^{-2} M
22. All prokaryotic organisms are classified under
- a) Archaeobacteria, Eubacteria, and Protists
 - b) Archaeobacteria and Protists
 - c) Protists and Eubacteria
 - d) Eubacteria and Archaeobacteria
23. Which of the following is the correct sequence showing the highest taxonomical grade (most inclusive) to lowest taxonomical grade (least inclusive)?
- a) Kingdom, Phylum, Domain, Order, Class, Family, Genus, Species
 - b) Kingdom, Phylum, Family, Class, Order, Genus, Species
 - c) Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species
 - d) Species, Genus, Family, Class, Order, Phylum, Kingdom
24. Which of the following is a poor immunogen?
- a) Enzymes
 - b) Antibodies
 - c) Glycogen
 - d) Whole yeast cell
25. Antigenic determinants of an antibody consist of
- a) Variable regions of light chains only
 - b) Variable regions of heavy chains only
 - c) Variable regions of both heavy and light chains
 - d) Constant regions of both heavy and light chains

PART B

[These questions may have more than one right answer. Mark all the correct answers. For eg. if there are three right answers for a particular question, all three options must be marked otherwise it will be considered incorrect]

26. Which of the following are true of sphingolipids?
- a) Cerebrosides and gangliosides are sphingolipids.
 - b) Phosphatidylcholine is a typical sphingolipid.
 - c) They always contain glycerol and fatty acids.
 - d) Sphingomyelin is a phosphosphingolipid
27. Which of the enzymatic reactions in the citric acid cycle produces high energy containing phosphate compound?
- a) Succinyl CoA synthetase
 - b) Succinate dehydrogenase
 - c) Isocitrate dehydrogenase
 - d) Citrate synthetase
28. Which of the following bonds/interactions is (are) **NOT** responsible for binding antibody to its cognate region on an antigen?
- a) Ionic interactions
 - b) Hydrophobic forces
 - c) Hydrogen bonds
 - d) Disulfide bonds
29. Which of the following statement(s) about antibodies is (are) **NOT** correct
- a) They serve as the specific receptors on B and T lymphocytes.
 - b) They are composed of two heavy (H) chains and two light (L) chains.
 - c) The two light (L) chains alone have the variable regions that can bind antigen.
 - d) The amino acid sequence within the variable (V) regions varies widely from one clone of B-cell to another
30. Which of the following genes code(s) for receptors that recognize(s) and present(s) foreign antigens only?
- a) Class I MHC
 - b) Class II MHC
 - c) Class III MHC
 - d) CD4 receptors
31. Which of the statements about **point mutations** are correct? They can be
- a) Induced by chemicals
 - b) Responsible for a genetic disease
 - c) Mapped by a technique similar to Maxam-Gilbert sequencing
 - d) Detected easily by Southern blotting
32. Identify the statements that describe correctly the events in transcription
- a) RNA synthesis initiates denovo (no requirement for primer)
 - b) 'U' is inserted opposite to 'T' during transcription
 - c) Sigma factor in bacterial polymerase is required for accurate initiation
 - d) Eukaryotic mRNA are capped with a modified 'G'
33. Identify the events that occur in the cytoplasm
- a) Polyadenylation of mRNA
 - b) Modification of tRNA
 - c) Assembly of small and large ribosomal subunits
 - d) Synthesis of protein
34. Degenerate codons are

- a) Usually different in the third base
- b) Third base is invariant
- c) Recognized by the same tRNA
- d) Different DNA sequences that encode the same amino acid

35. Which of the following statements about viruses are true?

- a) Have DNA or RNA as genetic material
- b) Encode their complete replication machinery
- c) Require a host cell for propagation
- d) Do not infect plants

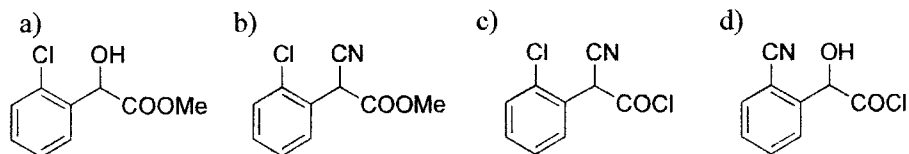
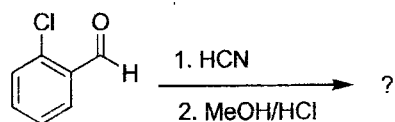
36. A buffer solution can be prepared from a mixture of

- a) Sodium acetate and acetic acid in water
- b) Sodium acetate and hydrochloric acid in water
- c) Ammonia and ammonium chloride in water
- d) Ammonia and sodium hydroxide in water

37. Which of the following is true for the rate constant of a chemical reaction?

- a) Depends only on temperature and catalyst
- b) Always increases with temperature
- c) Linearly related to rate of reaction
- d) Same for both directions in a reversible reaction

38.

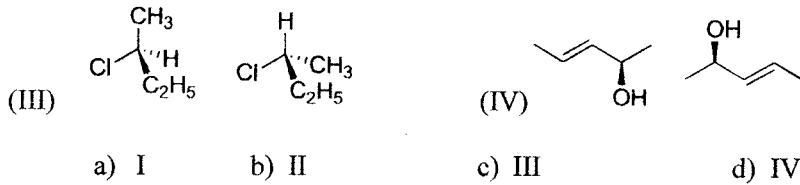


39. Which of the following compound(s) can react with PCl_5 to give POCl_3 .

- a) O_2
- b) CO_2
- c) SO_2
- d) H_2O

40. Which of the following pairs are enantiomers?





41. Which of the following will exemplify passive immunity?
- A person recovers from an infection
 - A person receives immune serum during treatment for hepatitis
 - A fetus receives maternal antibodies that cross the placenta
 - A person given BCG vaccine against tuberculosis
42. Which of the following is CORRECT for differentiating Crustaceans and Insects?
- Crustaceans alone have fused head and thorax making cephalothorax
 - Crustaceans have three pairs of legs in their thorax region
 - Only insects have tri-segmented body
 - Insects have ommatidia as photoreceptors
43. Which of the following statements are true for inbreeding?
- Leads to homozygosity
 - Improves hybrid vigour
 - Loss of heterosis
 - Always increases productivity
44. Which of the following statements about photorespiration is NOT true?
- Converts fixed carbon back into CO₂
 - C₄ photosynthesis counters photorespiration
 - Ribulose 1,5-bisphosphate is oxidized to CO₂ without production of ATP
 - Photorespiration produces NADPH
45. Which of the following events happen in telophase of mitosis?
- Dis-assembly of spindle apparatus
 - Alignment of chromosomes in the centre of the nucleus
 - Decondensing of chromosomes
 - Cell plate is formed
46. Which of the following steps occur in one or more models of recombination?
- Single-strand cleavage (nicking)
 - Double-strand cleavage.
 - Excision of damaged nucleotide.
 - Resolution.
47. Which of the following experiments will detect the presence of introns in mRNA?
- A comparison of the protein sequence with mRNA sequence
 - A comparison of the genomic DNA and cDNA sequences.
 - A hybridization between DNA and mRNA molecules.
 - Density-gradient centrifugation of total RNA
48. Which of the following is true for enzyme catalyzed reaction? Enzymes
- Force reactions to proceed in only one direction.
 - Do not alter the equilibrium of the reaction
 - Alter the standard free energy of the reaction
 - Can couple energetically unfavorable reactions to favorable ones

49. Which of the statements are true for HbF (Fetal Hb)
- Fetal Hb has higher affinity for O_2 than does maternal blood
 - Fetal hemoglobin (HbF) is a tetramer that contains two α - and two γ -chains
 - The HbF have a low affinity for BPG
 - Oxygen partial pressure P_{50} for HbA (Hemoglobin in Adults) is less than HbF
50. Which of the following statements are true for pollen tubes:
- It shows tip growth
 - Transports male gametes
 - Holds the anther lobes
 - Required for pollination
51. Amino acids that contain hydroxyl group in their side chains are
- Serine
 - Threonine
 - Tyrosine
 - Histidine
52. The common acceptor for amino group in transamination reactions are (is)
- α -keto glutarate
 - Oxaloacetate
 - Acetoacetate
 - Citrate
53. Which of the following structures mediate communication between cells?
- Gap junction
 - Lamina
 - Desmosomes
 - Microtubules
54. Gastric glands secrete gastric juice rich in HCl in response to
- Dietary food available in the stomach
 - Stimulation by gastrins the parietal cells in gastric glands secrete HCl
 - Stimulation of chief cells in gastric glands
 - Stimulation of neck cells in the gastric glands
55. Thiamine pyrophosphate is the prosthetic group in which of the following enzymes
- Pyruvate decarboxylase
 - Pyruvate carboxylase
 - Transketolase
 - Transaldolase
56. The conduction of a nerve impulse is an electro-chemical impulse. Which of the following is (are) true in the context of conduction of a nerve impulse through a nerve fibre?
- The neurilemma permits only K^+ ion to diffuse freely into and outside a neuron
 - The sodium pumps of the neurons are resting during resting potential
 - The sodium pumps actively transport Na^+ ions to the outside of the neuron under resting condition
 - Depolarization causes positive charges like Ca^{2+} and Na^+ to rush inside the neuron
57. Which of the following compounds has a higher group transfer potential for phosphate than ATP?
- Glucose 6-phosphate
 - 2-Phosphoenolpyruate
 - Creatine phosphate
 - Ribose 5-phosphate
58. Oxygenated and deoxygenated blood gets mixed in the heart of which of the following organisms?
- Fish
 - Frog
 - House lizard
 - Man

59. Under normal conditions, which of the following substances should NOT be found in urine?
 a) Urea b) Glucose c) Protein d) Creatinine
60. Which of following hormones are glycoprotein in nature?
 a) PRL b) FSH c) TSH d) B-endorphin
61. Beadle and Tatum isolated several mutants that were defective in arginine biosynthesis. However they found that they could group them into three classes based on complementation analysis. This suggested that
 a) Arginine biosynthesis required 3 enzymes
 b) Three different pathways exist for arginine biosynthesis
 c) Three different amino acids have to be provided as precursors
 d) Many different mutations were isolated in each of the genes
62. Identify the methods that are likely to be bactericidal:
 a) Ionizing radiation b) Membrane filtration
 c) Autoclaving d) Refrigeration
63. Which of the following features are unique to plasmids but not true for transposons
 a) Become inserted into chromosomes
 b) Replicated autonomously outside of the chromosome
 c) Depend on the host cell machinery for their propagation
 d) Move from chromosome to chromosome
64. Sedimentation velocity of a protein in a centrifugal field depends on which of the following properties:
 a) Charge of protein b) Shape of the protein
 c) Molecular mass of the protein d) pI of the protein
65. Which of the following phenomena contribute to variety and combination of maternal and paternal traits in offsprings?
 a) Recombination
 b) Random assortment of chromosomes during Metaphase I
 c) Errors during DNA replication
 d) Semi-conservative replication
66. Which of the following coenzymes are involved in enzymatic reduction reactions?
 a) Thiamine pyrophosphate b) NADH
 c) FAD+ d) NADPH
67. Unit of k_{cat} of an enzyme cannot be
 a) $M^{-1}s^{-1}$ b) s^{-1} c) M^{-1} d) min^{-1}
68. Which of the following biomolecules have only C, H and O?
 a) Glucose b) Glycerol
 c) Glycine d) Palmitic acid
69. Advantage(s) of *cis* double bonds (as opposed to *trans* double bonds) in fatty acids is that they

- a) Maintain membrane symmetry. b) Increase membrane rigidity.
c) Decrease membrane fluidity. d) Increase membrane fluidity

70. Choose all the statements that are **TRUE** about telomeres

- a) Telomeres contain regions with a high G content
b) Telomeres solve end-replication problem
c) Telomeres contain short repetitive sequences, which are invariant among different organisms
d) Telomeres contain non-Watson-Crick base pairing

PART C

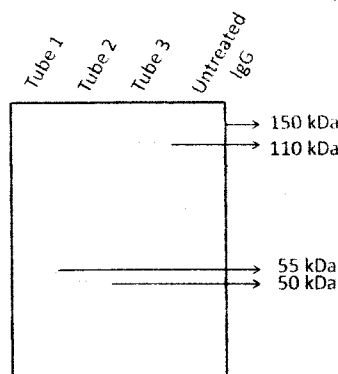
[Each Question has only one right answer. Mark the right answer]

71. Which option represents all the right pairs?

- P. Eukaryotic genome I) 10^4 bp
Q. Bacterial genome II) 10^5 bp
R. Chloroplast genome III) 10^6 bp
S. Viral genome IV) 10^8 bp

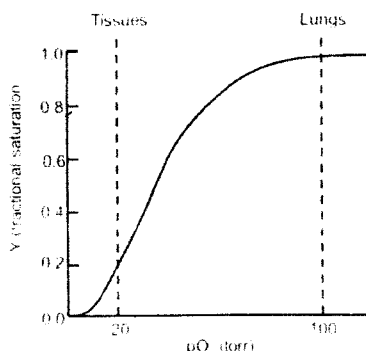
- a) P-I, Q-II, R-III, S-IV
b) P-IV, Q-III, R-II, S-I
c) P-V, Q-II, R-III, S-I
d) P-IV, Q-II, R-III, S-I

72. You took three tubes of immunoglobulin G (IgG), one was digested with papain, another was digested with pepsin and the last tube was digested with pepsin followed by reduction with Dithiothreitol (DTT). You, however, forgot to label the tubes. To resolve the problem, the digested IgG were fractionated on a denaturing PAGE (Poly-Acrylamide Gel Electrophoresis), tube 1 was loaded in lane 1, tube 2 loaded in lane 2 and tube 3 was loaded in lane 3. Based on the schematic gel picture of the denaturing PAGE, identify the tube digested with pepsin followed by reduction with dithiothreitol (DTT).

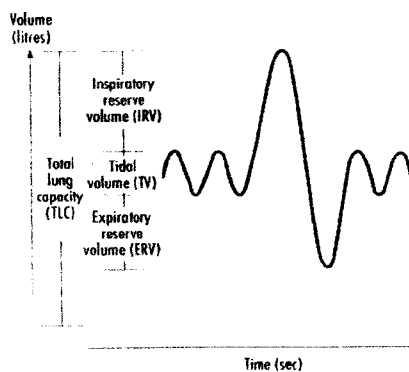


- a) Tube 1 b) Tube 2 c) Tube 3 d) Tube 1 or Tube 3

73. Given below is the oxygen-hemoglobin dissociation curve. If the pO_2 in the lung is 100 torr and pO_2 in the tissues is 20 torr, from the graph below, what percentage of oxygen picked up by hemoglobin in the lung will be released in the tissues?



- a) About 50% b) About 60% c) About 80% d) About 20%
74. Given below is a Spirogram labeled to show the subdivisions of the total lung capacity (TLC), which is 6000ml. The amount of air inspired during normal, relaxed breathing, that is, the tidal volume (TV) is about 500 mL, the inspiratory reserve volume (IRV) or the additional air that can be forcibly inhaled after normal inspiration, is about 3,100 mL, and the expiratory reserve volume (ERV), is about 1,200 mL. What are the Residual volume (RV), the vital capacity (VC) and the inspiratory capacity (IC) of the lung?



- a) RV= 1200 ml, VC= 3600 ml and IC= 2600 ml
 b) RV= 1200 ml, VC= 4800 ml and IC= 3600 ml
 c) RV= 1900 ml, VC= 4300 ml and IC= 3600 ml
 d) RV= 1200 ml, VC= 3600 ml and IC= 4800 ml
75. pK_1 (-COOH), pK_2 (-NH₃⁺), and pK_3 (side chain) of aspartic acid are: 1.88, 9.6 and 3.65 respectively. At which pH Asp will not move in an electric field?
 a) 5.74 b) 2.77 c) 6.6 d) 6.0
76. The standard cell potential (E°_{cell}) of the reaction below is +0.126 V. The value of ΔG° for the reaction shown below is

$$X(s) + 2H^+(aq) \longrightarrow X^{+2}(aq) + H_2(g)$$

- a) -24 kJ/mol b) +24 kJ/mol
 c) -12 kJ/mol d) +12 kJ/mol

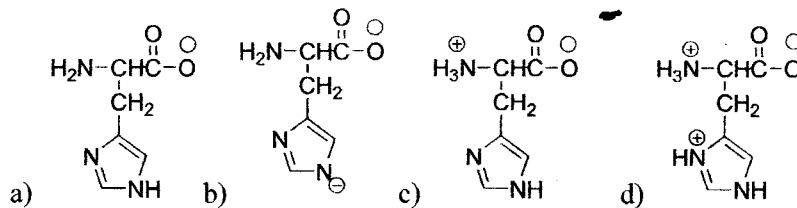
77. A population of DNA letters consists of equal numbers of each letter (A, T, G and C). The probability that a randomly selected letter from this population being either A or T is:

- a) 0.1 b) 0.5 c) 0.25 d) 0.4

78. In a sample consisting of lysine, leucine, and glutamic acid, which will be eluted first from a cation exchange resin at pH 1?

- a) All three will be eluted at the same time b) Lysine
 c) Leucine d) Glutamic acid

79. What would be the structure of histidine at pH 8.0?



80. What is the length and molecular mass of a polypeptide chain having 60 amino acids in a single contiguous α helix?

- a) 60 Å, 20 kDa b) 90 Å, 22 kDa c) 90 Å, 6.6 kDa d) 60 Å, 6.6 kDa

81. Which option best represents the order in which the proteins below are added during formation of the replication-initiation complex in prokaryotes?

- P. DnaB
 Q. Primase
 R. Pol III
 S. Ssb protein
 T. DnaA

- a) P-T-S-Q-R. b) T-P-S-Q-R.
 c) P-T-Q-S-R. d) T-P-Q-S-R.

82. Which of the following equation holds true for an enzyme's Michaelis-Menten equation when the substrate concentration is very low compared to its Michaelis constant K_m ?

- a) $v_0 = \frac{V_{max}}{K_m}$ b) $V_{max} = \frac{K_m \cdot v}{[S]} + \frac{1}{v}$

c) $\frac{k_{cat}}{K_m} = \frac{v}{[S].[E]}$

d) $\frac{k_{cat}}{K_m} = \frac{v[E]}{[S]}$

83. Match proteins to their functions.

- | | |
|------------------------|------------------------|
| i) haemoglobin | 1) enzyme |
| ii) γ -globulin | 2) mechanical strength |
| iii) collagen | 3) oxygen transport |
| iv) lipase | 4) immune protection |

- a) i-3, ii-1, iii-2, iv-4
 b) i-2, ii-4, iii-4, iv-1
 c) i-3, ii-4, iii-2, iv-1
 d) i-3, ii-4, iii-1, iv-2

84. Colour blindness is a recessive, non-X linked inherited disorder. A man whose father is totally colour blind marries a woman whose mother is totally colour blind. What is the probability that their offspring will be colour blind?

- a) 100% boys and 50% of girls
 b) 50% of boys and girls
 c) 25% of girls and 50% of boys
 d) 25% of boys and girls

85. Imagine you are having a delicious fruit salad. From 10 items, in how many ways can you select 3 items?

- a) 720 b) 60 c) 120 d) None of the above