

M-59

**ENTRANCE EXAMINATION, 2016**  
**Ph.D. Biotechnology**

Time: 2 hours

Maximum Marks: 75

HALL TICKET NO.

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**INSTRUCTIONS**

Please read carefully before answering the questions

1. Answers are to be marked on the OMR answer sheet following the instructions provided there upon.
2. Hand over the OMR answer sheet at the end of the examination to the Invigilator.
3. The question paper contains 75 questions of multiple-choice type printed in 13 pages, including this page. OMR answer sheet provided separately.
4. The marks obtained in Part-A will be used for resolving the tie cases.
5. All questions carry one mark each.
6. 0.33 marks will be deducted for every wrong answer.
7. Non-programmable scientific calculators are permitted.
8. Cell/Mobile phones are strictly prohibited in the examination hall.

## PART - A

1. Fatty acid methyl esters of varying carbon lengths can be separated by
  - a) Gas chromatography
  - b) Affinity column chromatography
  - c) Sucrose density gradient centrifugation
  - d) Ion exchange chromatography
  
- 2) Positively charged basic amino acids are
  - a) Lysine and arginine
  - b) Lysine and asparagine
  - c) Glutamine and arginine
  - d) Lysine and glutamine
  
- 3) If the Standard Gibb's free energy,  $\Delta G^\circ$ , for a reaction is positive then
  - a) the products will be favored
  - b) the reactants will be favored
  - c) the concentration of the reactants and products will be equal
  - d) all of the reactant will be converted to product
  
- 4) Succinate is converted to fumarate by succinate dehydrogenase. In the presence of reversible competitive inhibitor, malonate in place of succinate, the enzyme's
  - a)  $K_m$  decreases and  $V_{max}$  remains the same
  - b) both  $K_m$  and  $V_{max}$  decreases
  - c)  $K_m$  increases and  $V_{max}$  remains the same
  - d) both  $K_m$  and  $V_{max}$  increases
  
- 5) Which one of the following inhibits transcription?
  - a) Rifampicin
  - b) Chloremphenicol
  - c) Novobiocin
  - d) Kanamycin
  
- 6) A person's broca's area on his left hemisphere was affected when he experienced a stroke. What ability could be affected?
  - a) understanding what others say
  - b) being able to speak
  - c) being able to touch his nose
  - d) reading
  
- 7) Sex lethal (sxl) in *Drosophila* is transcribed when
  - a) the X autosome balance is less than 0.5
  - b) the X autosome balance is 1 or greater
  - c) the X autosome balance equals 0.5
  - d) none of the above

- 8) A synchronous culture is one in which the majority of cells proceed through
- Lag phase
  - Log phase
  - Exponential phase
  - Each cell cycle phase ( G1, S, G2 and M)
- 9) Which of the following statement is false:
- Large insoluble or aggregate macromolecules are more immunogenic
  - D-amino acid polymers are more immunogenic
  - L amino acid polymers can be easily degraded within APCs
  - B cell only recognizes antigen presented by class I or Class II molecules
- 10) One of the following is not molecular descriptor
- Molecular weight
  - Log P
  - Molecular absorption
  - Refractive index
- 11) Cells that release histamine and other vasoactive substances in response to allergens are:
- Neutrophils
  - macrophages
  - NK cells
  - mast cells
- 12) One of the following nucleotide substitution in the coding part of DNA is an example of synonymous substitution
- TCC to TCA (Serine to Serine)
  - GAC to CAC (Aspartate to Arginine)
  - TGG to TGA (Tryptophan to stop-codon)
  - GAA to GCA (Glutamate to Alanine)
- 13) When the power of ocular lens is 10 x and objective lens is 20 x, the magnification is
- 30 times
  - 20 times
  - 200 times
  - 2000 times
- 14) The following are true about antigen presenting cells (APC) EXCEPT:
- Langerhan cells are the antigen presenting cells of the epidermis
  - Expresses co stimulatory molecules
  - CD8+ cells only recognize antigen presenting cells bearing MHC I molecules
  - Follicular dendritic cells are professional antigen presenting cells.

- 15) Which of the following occur in the presence of glucose?
- lac Z gene expression is increased
  - cAMP increases
  - Binding of CAP-cAMP complex to the promoter area decreases
  - none of the above
- 16) SDS is used in polyacrylamide gel electrophoresis of a mixture of proteins for their efficient separation on the gel. SDS, in this experiment, is used to
- stabilize the protein
  - solubilize the protein
  - decrease the surface tension of buffer
  - have uniform charge density on the proteins
- 17) The  $\alpha\beta$ T cells recognizes antigenic peptides:
- only in the free form
  - only when loaded onto MHC molecule
  - only when bound to hapten
  - only when bound by antibodies
- 18) Which of the following mutations is most likely to be disruptive to protein synthesis or function?
- UAU to UAC
  - UAU to UUU
  - UAU to UAA
  - UAU to CAU
- 19) Which of the following separation method is best suited for a protein sample with large differences in molecular mass?
- Dialysis
  - Salting out process
  - Isopycnic centrifugation
  - Rate zonal centrifugation
- 20) Cell that has higher mitochondrial activity
- Lymphocytes
  - RBC
  - Neuron
  - Fibroblast
- 21) CD antigens
- allow leukocytes to recognize antigen
  - are each expressed on only one cell type
  - are expressed on immune cells to mark them for separation
  - function as receptors for cytokine and CAMs

- 22) Spectroscopy measures the change in behavior of a molecule when it is exposed to
- Centrifugal force
  - Acidic conditions
  - An electrical charge
  - Electromagnetic radiation
- 23) Following is a ligand-based drug design approach:
- Docking
  - QSAR
  - Dynamics
  - Monte Carlo
- 24) Among the following, which vector-borne disease is not transmitted by the mosquitoes?
- Chikungunya
  - Leishmaniasis
  - Lymphatic filariasis
  - Japanese encephalitis
- 25) Which one of the following amino acid is NOT post-translationally modified by phosphorylation
- Glycine
  - Serine
  - Threonine
  - Tyrosine

### PART-B

- 26) The mechanism by which a pH gradient across a membrane is used to drive an energy requiring process such as the rotation of bacterial flagella
- Proton-motive force
  - Chemiosmotic coupling
  - Oxidative phosphorylation
  - Electrochemical proton gradient
- 27) The pH of inter-membrane space, stroma and thylakoid lumen are
- 5, 7.5 and 7.0
  - 8, 5 and 7.5
  - 7, 7.5 and 5
  - 7, 5.0 and 7.5

- 28) Specific solutes move through the membrane much more slowly via transports than by channels. This is because
- Transporters must bind the solute and undergo a series of conformational changes to transfer the solute across the membrane
  - Transport through channels is much faster because they are ion specific pores that neither bind the ion nor undergo any conformational changes in order to move it across the membrane.
  - Transporters undergo a series of conformational changes and must bind the solute to transfer the solute across the membrane.
  - Both A and B
- 29) Which of the following participate in cell signaling despite present in very small quantities in the plasma membrane of mammalian cells
- Phosphatidylserine
  - Phosphatidylinositol
  - Sphingomyelin
  - Phosphatidylethanolamine
- 30) A technique which monitors the closeness of two fluorescently labelled molecules and their interactions in cells is
- NMR
  - FRET
  - Western blotting
  - Two-hybrid system
- 31) Which one of the following properties of an enzyme is responsible for its saturation behavior; that is, a maximum rate insensitive to increasing substrate concentration?
- The energy does not change the overall equilibrium constant for a reaction.
  - The enzyme has a fixed number of active sites where substrate binds.
  - The product of the enzyme reaction usually inhibits the enzyme.
  - The enzyme lowers the activation energy of a chemical reaction.
- 32) The half-life of one of the following radioactive isotopes is 5730 years. Identify it
- $^{35}\text{S}$
  - $^3\text{H}$
  - $^{14}\text{C}$
  - $^{32}\text{P}$
- 33) The specific activity of an enzyme would be reported in which of the following units of measure?
- Millimoles per liter
  - Units per milligram
  - Micromoles per minute
  - Milligrams per micromole

- 34) Which of the following monosaccharides is not a carboxylic acid?
- 6-phospho-gluconate
  - Gluconate
  - Glucose
  - Glucuronate
- 35) Arrange in sequence the following events that are performed during the isolation of genetic material in recombinant DNA technology
- Removal of DNA by spooling
  - Precipitation of DNA
  - Dissolution of biological membranes
  - Enzymatic digestion
- 1, 4, 2, 3
  - 3, 4, 1, 2
  - 4, 3, 2, 1
  - 1, 3, 2, 4
- 36) Cerebral aqueduct is associated with
- Broca's area
  - Wernicke's area
  - Angular gyrus
  - Ventricles
- 37) Deficiency of thymus results in increased infections in humans such a condition is called:
- Thymectomy
  - Graves disease
  - Di Georges syndrome
  - All the above
- 38) A redox reaction in the citric acid cycle which do not use  $\text{NAD}^+$  to accept electrons
- Oxidation of Fumarate
  - Oxidation of Succinate
  - Oxidation of Citrate
  - Oxidation of Oxaloacetate
- 39) The type of silencing involved in miRNA is
- Transcriptional
  - Translational
  - Post transcriptional
  - Post translational
- 40) Which of the following is an epimeric pair?
- D-glucose and D-glucosamine
  - D-glucose and D-mannose
  - D-lactose and D-sucrose
  - L-mannose and L-fructose

- 41) What type of enzyme is used in recombinant DNA technology to split a specific sugar phosphate bond in each strand of a DNA double helix?
- Esterase
  - Restriction enzyme
  - Lipase
  - Ligase
- 42) Which of the following detergent is commonly used to release integral proteins from its membranes?
- Urea
  - Dimethyl sulphoxide
  - Triton X 100
  - Cyanogen bromide
- 43) In which of the following separation method where proteins are separated on the basis of their net charge
- Ion exchange chromatography
  - Affinity chromatography
  - Dialysis
  - Gel filtration chromatography
- 44) Which of the following can precipitate antigens:
- Fab
  - Fc
  - F(ab)a
  - All
- 45) One of the following molecule binds to major groove of DNA
- Ethidium bromide
  - Distamycin
  - Cisplatin
  - Methyl green
- 46) You have been asked to PCR amplify a specific sequence from cDNA that was synthesized from mRNA isolated from brain tissue. After you run your potential PCR product on an agarose gel, you observe no bands when you visualize the gel using ultraviolet light. Why might this be the case?
- The gene you are interested in is not expressed in brain tissue.
  - You used poly dT instead of poly dA to prime the first strand cDNA synthesis.
  - You used RNase H instead of DNase H to leave behind small segments of RNA to prime the second strand cDNA synthesis reaction.
  - You used reverse transcriptase instead of DNA polymerase to synthesize the first strand of cDNA.

- 47) The specificity of a ligand binding site on a protein is based on
- the absence of competing ligands
  - the amino acid residues lining the binding site
  - the presence of hydrating water molecules
  - the opposite chirality of the binding ligand
- 48) *Staphylococci* causes
- Food intoxication
  - Food Infection
  - Food preservation
  - Food quality improvement
- 49)  $\alpha$ -amylase is produced by
- Saccharomyces cerevisiae*
  - Clostridium acetobutylicum*
  - Bacillus subtilis*
  - Saccharomyces cerevisiae*
- 50) An enzyme was purified to 1500-fold by applying different chromatographic steps to the 70% ammonium sulphate precipitated crude protein. If the enzyme is pure at this stage what fraction of the protein in the cell does it constitute?
- 70%
  - 0.07%
  - 7%
  - 30%
- 51) Catenated dsDNA molecules can be resolved leased by
- Topoisomerase I
  - Helicase
  - Resolvas
  - Topoisomerase II
- 52) Non-covalent pairing intermediate formed during homologous strand exchange is called
- Joint molecule
  - dsDNA
  - ssDNA
  - Triplex DNA
- 53) RecA bound helical nucleoprotein is formed through cooperative interaction with
- G-protein
  - Single strand binding protein
  - Beta-protein
  - S1-protein

- 54) Following is a classification method
- Support vector machine
  - Simulated annealing
  - Fragment assembly
  - Topological shapes
- 55) During splicing, which of the following snRNPs bind to a nucleotide sequence found in introns called the branch site.
- U1
  - U2
  - U4 and U6
  - U5
- 56) Following species escape from immune recognition
- Protein
  - Peptide
  - 1000 nm particle
  - 400 nm particle
- 57) If one requires to maintain pH at 4.2, which is best buffer
- Borate
  - Acetate
  - Phosphate
  - Borax
- 58) Which part of the brain controls eating, drinking, body temperature and provides a link between the brain and the endocrine system?
- Parietal lobes
  - Temporal lobes
  - Amygdala
  - Hypothalamus
- 59) Eukaryotic cells with DNA damage often cease progression through the cell cycle until the damage is repaired. This type of control over the cell cycle is referred to as
- Proteosome control
  - Damage control
  - Anticyclin control
  - Checkpoint control
- 60) Which lobe is connected with thinking, planning and emotional control?
- Frontal
  - Occipital
  - Temporal
  - Parietal

- 61) Different possess of a target receptor and ligand are simulated in
- Rigid docking
  - QSAR
  - CoMFA
  - Flexible docking
- 62) The class of immunoglobulin that can get transported across epithelial cells is
- IgG
  - IgE
  - IgA
  - IgM
- 63) Multiple sclerosis could disintegrate a neuron's \_\_\_\_\_, which ultimately could affect the speed of a neural impulse.
- Dendrites
  - Axons
  - Myelin Sheath
  - Synapse
- 64) You have been asked to conduct analyses of histones from active and inactive regions of chromatin, where genes are expressed and repressed respectively. While conducting your analyses, which of the following observations would be UNEXPECTED?
- Methylation of lysine residues in some histones is associated with establishment of heterochromatin, and results in gene silencing.
  - Serine residues in the tails of some histones have been phosphorylated, and this is associated with changes in chromatin activity.
  - Lysine residues in the histone tails have been serinated, resulting in inactive chromatin, where genes are not expressed.
  - Acetylation of lysine residues in some histones is associated with active regions of chromatin, where genes are expressed.
- 65) Which one of the following structures is NOT found in the central nervous system?
- Spinal cord
  - Thalamus
  - Pons
  - Dorsal root ganglion
- 66) Signal sequences are part of a protein that
- signal folding of the protein
  - signal the protein synthesis on the ribosomes is ended
  - transport proteins to other sites within the cell
  - refold proteins in prion-associated diseases
- 67) For specific antigen recognition by T cells,
- antigen is bound by a T cell membrane antibody
  - denaturation of antigen does not reduce epitope recognition
  - MHC molecules are not required
  - antigen exposure during T cell maturation is required

- 68) A virus vaccine that can activate cytotoxic T cells must contain
- a high dose of virus particles
  - an adjuvant to stimulate T cell division
  - live virus
  - virus peptides
- 69) Two couples present to the emergency room with severe nausea, vomiting, and diarrhea. One of the patients admits that she had a dinner party and served a salad containing mushrooms she had picked during a hike in the forest earlier that day. Inhibition of which enzyme or process explains the clinical manifestations of  $\alpha$ -amanitin poisoning seen in these patients?
- RNA polymerase II
  - RNA polymerase I
  - RNA polyadenylation
  - RNA polymerase III
- 70) The unfolding of regular secondary structure causes
- little increase in the entropy of protein
  - large decrease in the entropy of the protein
  - no change in the entropy of the protein
  - large increase in the entropy of the protein
- 71) Why is it that inhaling nitric oxide reduces blood pressure only in the lung tissue and not elsewhere in the body?
- Because other body tissues use a different signaling molecule
  - Because nitric oxide cannot cross cell membranes and enter the blood
  - Because nitric oxide breaks down quickly and thus cannot travel far
  - None of the above
- 72) Antibiotic that acts by inhibiting bacterial cell wall synthesis
- Erythromycin
  - Puromycin
  - Amphotericin
  - Penicillin
- 73) One of the following is not a prion disease
- Scrapie
  - Bovine spongiform encephalopathy
  - Creutzfeldt -Jacob Disease
  - Parkinson's disease
- 74) In the context of prokaryotic gene expression, which of the following is the most appropriate definition of an operator?
- A cluster of genes that are regulated by a single promoter.
  - A DNA-binding protein that regulates gene expression.
  - A non-coding, regulatory DNA sequence that is bound by RNA polymerase.
  - A non-coding, regulatory DNA sequence that is bound by a repressor protein.

- 75) The technique used to detect the presence of DNA or RNA in a non-fractionated DNA sample is
- a) in situ hybridization
  - b) colony hybridization
  - c) dot blot technique
  - d) western blotting technique