D-64

ENTRANCE EXAMINATION, 2013
Ph.D. Biotechnology

Time: 2 hours Maximum Marks: 75

HALL TICKET NO. [ ]

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 OMR answer sheet at the end of the examination.
3. The question paper contains 75 questions (Part –A Q. Nos. 1-25; Part –B: Q. Nos. 26-75) of multiple-choice type printed in 11 pages, including this page and the OMR answer sheet provided separately. Please check.
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 mark 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. Palmitic, stearic and oleic acid methyl esters dissolved in n-Hexane can be separated by
   A). Gas chromatography
   B). Affinity column chromatography
   C). Sucrose density gradient centrifugation
   D). Ion exchange chromatography

2) A nucleic acid sample containing DNA, t-RNA, mRNA and DNA-RNA hybrid was incubated with RNase H. which of the following nucleic acids would remain intact in the sample after treatment?
   A). DNA, tRNA, DNA-RNA hybrid
   B). mRNA, tRNA, DNA-RNA hybrid
   C). DNA, tRNA and mRNA
   D). DNA-RNA hybrid, mRNA and DNA

3) Which one of the following amino acid is coded by a single codon
   A). Tryptophan
   B). Serine
   C). Threonine
   D). Tyrosine

4) The most widely used penicillin-selection method for isolating auxotrophic mutants is a kind of ..... selection.
   A). Negative
   B). Positive
   C). Neutral
   D). Natural

5) Which one of the following molecule involved in photosynthetic electron transport is a protein
   A). Plastoquinone A
   B). Plastocyanin
   C). PQH_2
   D). P680

6) The exocyclic amino group on C6 of adenine in a A:T base pair is a
   A). Hydrogen bond acceptor
   B). Hydrogen bond donor
   C). Not involved in hydrogen bonding
   D). Hydrophobic functional group

7) Genetic engineering has been employed in fruit crops to suppress ethylene synthesis by modulating the activity of
   A). Glycerol phosphate dehydrogenase
   B). Phosphofructokinase
   C). ACC oxidase
   D). Fructose bisphospatase

8) Replacement of serine with one of the following amino acid is a conservative substitution
A). Threonine
B). Asparagine
C). Lysine
D). Glutamic acid

9) The fatty acid normally attached to the amino terminal glycine residue of an acylated protein is
A). Oleate
B). Palmitate
C). Myristate
D). acetyl

10) Which one of the following *E.coli* sigma factor is NOT an alternative sigma factor
A). RpoN
B). RpoH
C). RpoS
D). RpoD

11) Which of the following forms of DNA is left-handed
A). B-form DNA
B). A-form DNA
C). Z-form DNA
D). Heat denatured DNA

12) Metal that is used in gene-gun for bombardment of plant tissues
A). Zinc
B). Tungsten
C). Copper
D). Iron

13) Higher the salt concentration of the DNA solution
A). Lower the temperature at which the DNA denatures
B). Greater the temperature at which the DNA denatures
C). Lower the T_m, but has no effect on DNA denaturation
D). Lower the T_m

14) A plasmid DNA sample consisting of highly supercoiled DNA, nicked circular DNA, and linear DNA has been separated by agarose gel electrophoresis. Which of the following order of DNA bands from –ve to +ve electrode can be seen?
A). Nicked circular DNA, linear DNA, highly supercoiled DNA
B). Highly supercoiled DNA, linear DNA, nicked circular DNA
C). Linear DNA, nicked circular DNA, highly supercoiled DNA
D). Highly supercoiled DNA, nicked circular DNA, linear DNA

15) In general, comparison of genomes from various organisms indicates
A). Prokaryotes have higher gene density than eukaryotes
B). Eukaryotes have higher gene density than prokaryotes

C). No difference in gene density between prokaryotes and eukaryotes
D). None of the above

16) Length of an ORF from *E. coli* genome is 300 base pairs including its start and stop codons. What is the length of the corresponding protein?
A). 100 amino acids
B). 99 amino acids
C). 98 amino acids
D). 300 amino acids

17) Trans-splicing is
A). splicing of two exons of a preRNA during translation
B). splicing of two exons carried on different RNA molecules
C). splicing between bacterial RNA and an eukaryotic RNA
D). splicing of alternative exons of a single unspliced RNA

18) Which of the following relationships between absorbance and %transmittance is incorrect?
A). $A = \log_{10} 100 / \%T$
B). $A = 2 - \log_{10} \%T$
C). $A = \log_{10} 1 / T$
D). All are correct

19) In bacteria Shine-Dalgarno sequence base pairs with
A). Pyrimidine-rich sequence at the 3' end of the 16S ribosomal RNA
B). Purine-rich sequence at the 3' end of the 16S ribosomal RNA
C). Purine-rich sequence at the 5' end of the 16S ribosomal RNA
D). Poly-A sequence at the 5' end of the 16S ribosomal RNA

20) Which of the following statement is NOT TRUE
A). Highly competent *E. coli* cells do not occur naturally
B). dNTPs can be polymerized during PCR amplification
C). Plasmids are essential for normal bacterial cell growth
D). Plant genetic engineering is also possible without *Agrobacterium tumefaciens*

21) Which of the following is an inhibitor of gyrase
A). Rifampicin
B). Chloremphenicol
C). Novobiocin
D). Kanamycin

22) The relationship between fatty acids and membrane fluidity is;
A). Fluidity decreases with an increase in the ratio of unsaturated to saturated fatty acids
B). Fluidity increases with a decrease in the ratio of saturated to unsaturated fatty acids
C). Fluidity decreases with parallel rise in both saturated and unsaturated fatty acids
D). Fatty acid unsaturation has no effect on membrane fluidity

23) How many milliliters of a 400 mM NaOH solution are required to bring the pH of 20 milliliters of a 400 mM HCl solution to 7.0
A). 4
B). 40
C). 10
D). 20

24) Which of the following vector is a λ-based hybrid type cloning vector
A). pBR327
B). pJB8
C). pT7blue
D). λEMBL4

25) Which of the following technique is used for locating the transcription start site
A). Primer extension analysis
B). Transcriptome analysis
C). Real time PCR
D). RNA dot blot technique

PART-B

26) Targeted inactivation of a gene coding for a putative transcription factor has resulted in an induced expression of 'gene A'. The putative transcription factor can be
A). an activator
B). a repressor
C). an enhancer
D). an inducer

27) The first oxidative decarboxylative reaction in the Citric acid cycle is
A). Conversion of OAA to citrate
B). Conversion of Isocitrate to α-ketoglutarate
C). Conversion of α-ketoglutarate to succinyl CoA
D). Conversion of pyruvate to acetyl Co A

28) The immunoglobulin that results in histamine release is
A). IgG
B). IgM
C). IgE
D). IgD

29) An example of innate immunity is
A). T-lymphocytes
B). B-lymphocyte
C). Neutrophils
D). Thyroid cells

30) The tuberculin skin test is an example of
A). Type IV delayed hypersensitivity
B). Allergy reaction
C). Serum sickness
D). Precipitation reaction

31) Cytotoxic T cells are distinguished from Helper T cells by the presence of?
A). CD2
B). CD3
C). CD8
D). Class II MHC antigen

32) High sugar concentrations are not recommended in the fermentation because
A). Crystallization of high sugar concentrations
B). The process will be slow because of crystallization of calcium lactate
C). Calcium lactate will not be produced
D). All

33) In copper recovery the organism being used in bleaching process is
A). *Thiobacillus ferrooxidans*
B). *Aspergillus niger*
C). *Pseudomonas aeruginosa*
D). *Desulfovibrio desulfuricans*

34) Glycogen yields the following products on treatment with dimethyl sulfate followed by hydrolysis. Identify which product is produced in more abundance.
A). The residue at the reducing end of the glycogen molecule
B). Residues at the α(1→6) branch points
C). Residues from the linear α(1→4)-linked segments of glycogen
D). Residues at the non-reducing ends.

35) Trypsin belong to the following class of proteases
A). Aspartic
B). Serine
C). Metallo
D). Cysteine

36) If G6P is labeled at its C2 position, where will the label appear in the products of the pentose phosphate pathway?
A). C1 and C3 of F6P
B). C1 and C4 of F6P
C). C2 and C4 of F6P
D). C2 and C3 of F6P

37) $H_2{}^{18}O$ is added to a suspension of chloroplasts capable of photosynthesis. Where does the label appear when the suspension is exposed to light.
A). Phosophoglyceraldehyde
B). Fructose-6-phosphate
C). Oxygen
D). Dihydroxyacetonephosphate

38) The decarboxylation product of the following amino acid is a potential local mediator of allergic reactions.
A). Tyrosine
B). Glycine
C). Histidine
D). Glutamine

39) Chymotrypsin specifically binds to TPCK because of its resemblance to the amino acid residue
A). Lysine
B). Cysteine
C). Phenylalanine
D). Tyrosine

40) A molecule of DNA having 10 kbp, when treated with restriction digestion gives 5 kbp DNA on agarose gel. Please note that the only one site of cleavage was available in the DNA. What will be the form of DNA.
A). Supercoiled DNA
B). knotted DNA
C). caternated DNA
D). nicked circular DNA

41) A sample showed a CD spectrum with a positive peak followed by negative trough around 280 nm. This sample may be composed of:
A). B-DNA
B). C-DNA
C). A-DNA
D). Z-DNA

42) Covalent bonding with DNA is not exhibited by one the following molecule,
A). Ethedium bromide
B). Cisplatin
C). Distamycin
D). Bleomycin

43) Following molecular form of DNA may partition into acidic phenol layer
A). Closed circular DNA
B). Linear DNA
C). ssDNA
D). Nicked circular DNA

44) Protease specifically cleaving peptide bonds on the carboxyl side of glutamate and aspartate residues is
A). Trypsin
B). HIV protease
C). Pepsin
D). V8 protease

45) The virus integrates into the host genome though integration is not essential for its replication.
A). HIV
B). Lambda phage
C). HTLV-1
D). HBV

46) Following property of nanoparticles is most important for their functional significance in vivo
A). High Stability
B). Low immunogenicity
C). Non-specificity
D). High reactivity

47) Ku-70 proteins frequently associated with following repair mechanism:
A). Mismatch
B). base-excision
C). nucleotide- excision
D). double strand breaks

48) Rec A protein binds to one of the following substrate with high affinity
A). Supercoiled DNA
B). Linear double stranded DNA
C). Single stranded DNA
D). Nicked circular DNA

49) One for following is mismatch:
A). Topoisomerase II
B). Gyrase
C). Topoisomerase I
D). Resolvase

50) The most widely used scoring matrices for protein sequence alignments (e.g. BLOSUM matrices) are based on
A). Genetic code for amino acid
B). Simple identity
C). Physico-chemical properties of amino acid
D). Statistics of observed substitutions in multiple sequence alignments

51) Which of the following is true for Smith-Waterman Algorithm?
A). used for global alignment
B). used for local alignment
C). is a genetic algorithm
D). is used to construct the phylogenetic tree

52) What is the principle application of the BLAST algorithm?
A). Aligning two protein sequences from end to end.
B). Identifying sequences that are similar to a protein or nucleotide sequence in a biological sequence databases.
C). Identifying the best possible alignment of two short DNA sequences.
D). To retrieve the sequence of a gene of interest.

53) The necrotic spots on a virus infected leaf is due to
A). Toxic exudates of virus
B). Dead cells as a result of virus infection
C). Toxic exudates of leaf
D). Just discoloration

54) Which is false statement concerning the satellite viruses
A). Contain nucleic acids
B). Helper virus needed
C). Not encapsidated
D). No replication

55) The following viruses are being used as delivery vectors in gene therapy except
A). Adenoviruses
B). Herpes viruses
C). Retro viruses
D). All

56) Which of the following radio active labels that you recommend for the study of replication of an RNA virus
A). ^{32}P
B). ^{14}C-uridine
C). ^{3}H-thymidine
D). ^{35}S

57) One of the reasons behind the successfulness of developing a vaccine for small pox virus when compared to the HIV is
A). Small pox is a DNA virus and the HIV is a RNA virus
B). Existence of natural positive control for Small pox
C). HIV codes for reverse transcriptase
D). None of the above answers are correct

58) Which one of the following techniques is used for studying conservation or diversity of bacterial gene pools across evolution
A). Differential display
B). RFLP analysis
C). Multi-locus sequence typing (MLST)
D). RNAi

59) Which one of the following genome classes DO NOT have any significant novel gene content
A). Enterobacteriacea
B). *Mycobacterium tuberculosis* complex
C). Cyanobacteria
D). Spirochaetes

60) Gain of fitness by pathogens could be due to
A). Horizontal gene transfer (HGT)
B). Genome reduction
C). Mutation
D). All of the above

61) Which of the following is the method to carry out phylogenetic analysis?
A). Neighbor-joining method
B). Maximum parsimony method
C). Bayesian network method
D). all the above methods

62) The following is not a chronic human pathogen
A). *Salmonella typhi*
B). *Mycobacterium tuberculosis*
C). *Helicobacter pylori*
D). *Streptococcus pneumonia*

63) Which one of the following cytokines is not proinflammatory?
A). IL-8
B). TNF-alpha
C). IL-6
D). IL-10

64) Which of the following tools is used to identify phage like sequences
A). PhiSpy
B). Alien Hunter
C). PHAST
D). All of the above

65) The following are the revolutionary approaches that gave birth to very high throughput next generation sequencing platforms
A). Massive parallelization
B). Miniaturization
C). Advanced microfluidics
D). All of the above

66) The following assay is not used to detect apoptosis
A). DNA ladder assay
B). Tunel assay
C). Caspase-3 assay
D). Comet assay

67) In the equation, $A = \varepsilon bc$, what quantity is represented by "ε"?
A). Absorbtivity
B). Molar absorbtivity
C). Path length
D). None of these

68) In gas chromatography, the basis for separation of the components of the volatile material is the difference in
A). Partition coefficients
B). Conductivity
C). Molecular weight
D). Molarity

69) Which amino acids would most likely reside in the membrane-anchoring domain of a membrane embedded protein?
A). Isoleucine, valine and phenylalanine
B). Phenylalanine, valine, and aspartate
C). Leucine, threonine, and lysine
D). Lysine, arginine and histidine

70) In a polypeptide average mass of an amino acid residue is
A). 118 daltons
B). 80 daltons
C). 110 daltons
D). 150 daltons

71) Coomassie Blue stains the proteins by reacting with
A). free c-termini
B). arginine residues
C). peptide bonds
D). aromatic ring

72) Which of the following is not true about point mutation?
A). can be induced by chemicals.
B). can be responsible for a genetic disease.
C). can be mapped by a technique similar to Maxim-Gilbert sequencing.
D). can be detected easily by Southern blotting.

73) Topoisomerase I activity
A). cuts one strand of DNA double helix
B). cuts both strands of a DNA double helix
C). changes the linking number by 2
D). requires energy supplied by ATP

74) For the following *E. coli* diploids, indicate whether the strain is inducible or constitutive, or negative for β-galactosidase and permease, respectively?
Genotype: *i- o+ z- y+ / i- o^c z+ y+*
A). Negative for β-galactosidase and constitutive for permease
B). Negative for β-galactosidase and inducible for permease
C). Constitutive for both
D). Inducible for both

75) The mRNA produced from the lac operon would not hybridize to
A). the *lacI* gene
B). the *lac* operator sequence
C). the *lacY* gene
D). the *lacZ* gene with a single amino acid substitution