

**SECTION 1 - SECTION 1**

**Question No.1**



Let us assume, for a given protein sequence, the occurrence of cysteine residues is 20%. Suppose if you get three different sequences of the same length, what is the probability that one of three sequences will have cysteine?

- 0.384
- 0.2
- 0.8
- 0.128

**Question No.2**



Which method is used for predicting protein tertiary structure in the absence of homology to a known structure?

- Abinitio prediction
- Surface modelling
- Comparative modelling
- Threading

**Question No.3**



Where is the genetic information stored in the DNA molecule?

- In the secondary structure of the DNA
- In the sugar-phosphate backbone of the DNA
- In between the two strands of the DNA
- In the sequences of nucleotides of the DNA

**Question No.4**



Helminths are multi-cellular eukaryotic pathogens with complex life cycles which present particular problems to the body. Which is the most effective immune response to eradicate them?

- Th17 and neutrophil responses
- Th2, IgE and eosinophil response
- Th1, IgG2 and macrophage activation
- Th2, IgG1 and complement activation

**Question No.5**



Which of the following is the function of white blood cells?

- Prevent blood clotting
- Produce RBC and hemoglobin
- Defend against infection
- Transport oxygen and CO<sub>2</sub>

**Question No.6**



Tay-Sachs disease is caused by deficiency of \_\_\_\_\_?

- Alpha-L-iduronidase
- Glucose-6-phosphatase
- Hexosaminidase A

- Homogentisic acid oxidase

**Question No.7**



During siRNA-mediated gene silencing within the Homo sapiens cell, the RNA-induced Silencing Complex (RISC) is composed of which of the following protein arrangements?

- DICER1, TRBP and AGO1
- DICER1, TRBP and AGO2
- DICER, DROSHA and AGO1
- DROSHA and DGCR8

**Question No.8**



How many metallic magnetic bricks, each measuring the size of 20 cm x 30 cm x 40 cm, will be needed to build a wall of 8 m x 6 m x 4 m.

- 2400
- 1600
- 4000
- 8000

**Question No.9**



In cancer condition, genes can be either repressed or over-expressed. Repression of genes by DNA methylation depends on

- Low CpG density
- High CpG density and Promoter strength
- Promoter strength
- High CpG density

**Question No.10**



The mean of the length of the 20 similar crystal is 5 mm, and the standard deviation is 1.82 mm. What is the value of the coefficient of variation?

- 1.34%
- 3.64%
- 0.36%
- 36.40%

**Question No.11**



What is the approximate amount of neutrophils present in the white blood cells?

- 50-70%
- 60-80%
- 40-50%
- 40-60%

**Question No.12**



Threading is a procedure whereby?

- Due to high sequence similarity between proteins of unknown and known structure, the structure of the latter is used as a template to model the former
- A protein of unknown structure is compared against a library of fold templates to find the best match
- Due to high sequence similarity between proteins of unknown and known structure, the same function is assumed for both

- Due to low sequence similarity between proteins of unknown and known structure, the structure is predicted from first principles

**Question No.13**

Which one are the best examples of a multiple sequence alignment program?

- BLAST
- ENTREZ
- FASTA
- CLUSTALW

**Question No.14**

In an EMSA experiment free DNA is separated from protein-DNA complexes in a native gel by which following principle?

- Antibody immunoprecipitation
- DNA digestion with DNase
- Molecular weight
- Charge

**Question No.15**

The DNA-Histone complex is the best example for

- Quaternary structure of DNA
- The secondary structure of DNA
- Primary structure of DNA
- The tertiary structure of DNA

**Question No.16**

Alu elements are

- SINEs
- DNA transposon
- LINEs
- Retroposon

**Question No.17**

How the saturated fatty acids carbon atoms connect each through?

- Chain of double bonds
- Chain of triple bonds
- Chain of single and double bonds
- Chain of single bonds

**Question No.18**

What is the purpose of the research?

- To test our theoretical idea using experimental work
- To publish a paper and get a Ph.D. degree
- To obtain more data
- To extend the conceptual understanding of a topic

**Question No.19**

Which of these techniques is often considered a suitable "polishing" step in a protein purification strategy?

- Size-exclusion chromatography (SEC)
- Affinity chromatography (AC)
- Hydrophobic interaction chromatography (HIC)
- Ion-exchange chromatography (IEX)

**Question No.20**

Which widely expressed membrane bound complement control protein can inhibit all 3 pathways (alternative, lectin and classical) in order to limit tissue damage during immune responses?

- Factor I
- Decay Accelerating Factor (CD55)
- Factor H
- Complement Receptor 1 (CR1, CD35)

**Question No.21**

Which of the following types of genetic changes is least likely to be found in an oncogene in a tumor?

- Nonsense mutation
- Missense mutation
- Gene amplification
- Chromosome translocation

**Question No.22**

Which one of the following techniques help to determine the three-dimensional structure of the biomolecules?

- Thin layer chromatography
- X-ray crystallography
- Light scattering
- SDS-PAGE

**Question No.23**

Which statement best describes the main distinction between the origin of the two classes of small regulatory RNAs: siRNA and miRNA?

- siRNAs originate from predominantly exogenous dsRNA; miRNAs originate from the cell genome
- miRNAs are expressed whenever siRNAs are unable to appropriately degrade RNA sequences
- miRNAs are processed from dsRNA viruses, siRNAs are processed from ssRNA viruses
- siRNAs originate within the cell cytoplasm; miRNAs originate from the cell genome

**Question No.24**

Which algorithm is used by local alignment?

- Needleman and Wunsch
- PAM
- SmithWaterman
- All the above

**Question No.25**

Which one of the following databases gives immunoglobulin information?

- PIR
- PDB
- HTGS
- IMGT

**Question No.26**



You need to use a first generation sequencing method for de novo sequencing, which template should give optimum results for this project?

- Bacterial artificial chromosome
- Genomic DNA
- PCR product
- Plasmid DNA

**Question No.27**



Which of the following proteins is a death receptor which triggers the extrinsic pathway of apoptosis?

- Fas
- Caspase 8
- FADD
- Fas ligand

**Question No.28**



Which is the repeating sequence of amino acids present in the collagen?

- Gly-Hyp-Pro*
- Gly-Ala-Y*
- Gly-Pro-Ala*
- Gly-Pro-Y*

**Question No.29**



Which of these is an advantage of difference in-gel electrophoresis (DiGE) compared to gel-free approaches?

- Proteins are identified as part of the quantification
- Intact proteins allow detection of changes in protein modification
- Allows a greater range of proteins to be analysed
- More sensitive

**Question No.30**



What is nucleoside?

- Base + pentose sugar + phosphate
- Base
- Base + pentose sugar
- Pentose sugar

**Question No.31**



If the two dice are thrown simultaneously, what is the probability of getting the sum of the dices is 5 or 11?

- 4
- 6
- 8

**Question No.32**



Which of the following statements is correct, according to Chargaff's rules?

- All DNA molecules contain the same proportions of A, C, G and T.
- In double-stranded DNA, the amount of G equals the amount of C.
- In double-stranded DNA, the amount of T equals the amount of C.
- Single-stranded RNA molecules contain the same amount of A and U

**Question No.33**



Where and by what cells is hemoglobin made?

- In the liver, by Kupffer cells
- In the spleen, by monocytes
- In the bone marrow, by RBC precursors
- In the bone marrow, by megakaryocytes

**Question No.34**



What properties of a protein does hydrophobic interaction chromatography exploit for purification?

- Enzyme activity
- Hydrophobic amino acids on the protein surface
- Molecular weight
- Charged amino acids

**Question No.35**



If your quantitative proteomics experiment contains a large number of samples, which of these would be a good method to choose?

- iTRAQ
- Label-free quantification
- Western blotting
- SILAC

**Question No.36**



During DNA replication, which model has the double-stranded segments of both parental and daughter strands?

- Both conservative and semi-conservative
- Semi-conservative
- Dispersive
- Conservative

**Question No.37**



Which of the followings are literature database?

- PubMed and MEDLINE
- PubMed and PDB
- PDB and MEDLINE
- PDB and NCBI

**Question No.38**



Of the following, which are the common two amino-acids involved in the salt bridge?

- Aspartic acid – Serine
- Glutamic acid – Serine
- Aspartic acid – Lysine
- Glutamic acid – Asparagine

**Question No.39**



A pair of genes in two organisms of different species which are similar and they are strongly predicated to have the same function is known as:

- Homologous genes
- Paralogous genes
- Isoforms
- Orthologous genes

**Question No.40**



In the following, which one is NOT the “stop” codon?

- UGA
- UGG
- UAG
- UAA

**Question No.41**



During the light phase of photosynthesis, which one is reduced, and which one is oxidized?

- Water and CO<sub>2</sub>
- NADPH and CO<sub>2</sub>
- NADP and Water
- Water and NADP

**Question No.42**



Which enzyme used to separate double stranded DNA into single strand DNA?

- Helicase
- DNA polymerase
- Ribosome
- RNA primer

**Question No.43**



What is meant by the hypochromic effect of DNA?

- DNA UV absorption decreases when it forms a double strand
- DNA UV absorption decreases when it forms a single strand
- DNA UV absorption increases when it forms a double strand
- DNA UV absorption remains the same during a single strand and double stand formation

**Question No.44**



Which of the systems below would typically necessitate the use of a viral vector and packaging cell line system for shRNA delivery?

- To silence a gene of interest that is known to be expressed at high abundance in a cell line with a slow division rate

- To silence a gene of interest that is known to be expressed at low abundance in a cell line with a fast division rate
- To silence a gene of interest that is known to be expressed at high abundance in primary cells
- To silence a gene of interest that is known to be expressed at low abundance in a cell line with a slow division rate

**Question No.45**

For which of the following is Polymerase Chain Reaction NOT used?

- To generate double stranded DNA for DNA sequencing
- To diagnose a genetic disorder
- To generate copies of a target piece of DNA
- To detect bacteria or virus

**Question No.46**

Which of the following pH, the electrophoretic separation of leucine from a protein sample would be least effective?

- 7.4
- 1.8
- 0
- 3.7

**Question No.47**

Which one of the following is a secondary protein structure database?

- SCOP
- ChemBank
- PubChem
- PDB

**Question No.48**

Which one of the following nucleic acid forms a left-handed helix?

- B-DNA
- A-DNA
- T-DNA
- Z-DNA

**Question No.49**

What is the first step in photosynthesis?

- Photolysis
- Photophosphorylation
- Phosphorylation
- Oxidative phosphorylation

**Question No.50**

Which is the common algorithm used to produce global alignment between pairs of DNA or protein sequences?

- Needleman-Wunsch
- Dot matrix
- Smith-Waterman



- BLOSUM

**Question No.51**

Which one of the following statements is correct?

- Homologous sequence refers to protein sequences that are related through gene duplication events with variable biological function
- Homologous sequence refers to protein sequences that have identical sequences, structures, and function
- Homologous sequence refers to protein sequences found in a different organism that are so much alike that they almost certainly have a similar 3D structure and biological function
- Homologous sequence refers to protein sequences that have originated from a common ancestor with similar biological function

**Question No.52**

In the photosynthesis system, where NADPH is produced?

- Chloroplast
- ADP synthase
- Photosystem II
- Photosystem I

**Question No.53**

Which BLAST program is used by conserved domain database?

- BLASTN
- BLASTP
- PSI BLAST
- SNP BLAST

**Question No.54**

Which of the following statements is true of Na<sup>+</sup>/K<sup>+</sup>-adenosine triphosphatases?

- Their actions maintain a membrane potential with a value often of approximately -60 mV; the interior of the cell being positive with respect to the exterior
- They are tetramers, consisting of four equally sized polypeptide chains
- They indirectly control the volume of the cell
- They use the free energy from the hydrolysis of ATP to transport K<sup>+</sup> out the cell and Na<sup>+</sup> into the cell

**Question No.55**

A train crossed a 3000 m long in five minutes. What is the speed in km per hour?

- 72
- 10
- 18
- 36

**Question No.56**

Male breast cancer is associated with mutations in \_\_\_\_.

- RET
- BRCA2
- BRCA1

NF1

**Question No.57**

In the yeast two-hybrid system, which of the following statements is accurate: A reporter gene

- Is fused to the DNA binding domain of a transcription factor
- Is expressed only if the tested protein interaction occurs
- Is fused to the activation domain of a transcription factor
- Requires the presence of Histidine in the growth medium for its expression

**Question No.58**

Which are the compounds produced during light-dependent reactions?

- ATP and NADP+
- ADP and NADP+
- ATP and NADPH
- ADP and NADPH

**Question No.59**

A right triangle with sides 5 cm, 6 cm, and 7 cm has rotated the side of 5 cm to form a cone. What is the volume of the cone so formed?

- $100\pi \text{ cm}^3$
- $200\pi \text{ cm}^3$
- $150\pi \text{ cm}^3$
- $50\pi \text{ cm}^3$

**Question No.60**

Which one of the PAM matrix represents amino acid substitutions that occur in distantly related proteins?

- PAM1
- PAM60
- PAM45
- PAM250

**Question No.61**

Which one of the following numbers is divisible by each one 3, 7, and 11?

- 231
- 210
- 99
- 154

**Question No.62**

Which is the best nonparametric statistical method used to analyse the nominal data?

- Chi-Square test
- Mann Whitney
- Spearman's Rho
- Wilcoxon

**Question No.63**

In prokaryotic cells, which one provides the power to ATP production in the citric acid cycle?

- Coenzyme motive force
- H<sup>+</sup> gradient
- cAMP
- GTP hydrolysis

**Question No.64**

What is the main difference between the chlorophyll a and b molecules?

- Chlorophyll a has methyl group, and chlorophyll b has aldehyde group at their respective C7 positions
- There is no binding site in the porphin group in chlorophyll b
- Chlorophyll b has methyl group, and chlorophyll a has aldehyde group at their respective C7 positions
- There is no binding site in the porphin group in chlorophyll a

**Question No.65**

The type of immunity seen in a successful tumour is:

- Anti-inflammatory
- Cytotoxic
- Pro-inflammatory
- Anti-angiogenic

**Question No.66**

Which antibodies are most diagnostic for rheumatoid arthritis?

- Anti-citrullinated peptide antibodies
- Anti-phospholipid antibodies
- Anti-myeloperoxidase antibodies
- Anti-nuclear antibodies

**Question No.67**

Marked microsatellite instability is a feature of:

- Multiple endocrine adenomatosis type 2
- Hereditary non-polyposis colon cancer (HNPCC)
- Familial adenomatous polyposis.
- Neurofibromatosis 1

**Question No.68**

Which is the unique cyclic amino acid, which plays an essential role in terminating alpha helices?

- Serine
- Histidine
- Proline
- Arginine

**Question No.69**

How many signals does the aldehyde (CH<sub>3</sub>)<sub>3</sub>CCH<sub>2</sub>CHO have in <sup>13</sup>C NMR and <sup>1</sup>H NMR spectra?

- Four <sup>13</sup>C signals, and five <sup>1</sup>H signals

- Six  $^{13}\text{C}$  signals, and three  $^1\text{H}$  signals
- Six  $^{13}\text{C}$  signals, and five  $^1\text{H}$  signals
- Four  $^{13}\text{C}$  signals, and three  $^1\text{H}$  signals

**Question No.70**

What is alpha helix?

- It is a right-handed rod-like helical segment stabilized by intra-molecular hydrogen bonds, parallel to the helix axis, occurring between NH and C=O groups
- It is a left-handed rod-like helical segment stabilized by inter-molecular hydrogen bonds, parallel to the helix axis, occurring between NH and C=O groups
- It is a left-handed rod-like helical segment stabilized by intra-molecular hydrogen bonds, parallel to the helix axis, occurring between NH and C=O groups
- It is a right-handed rod-like helical segment stabilized by inter-molecular hydrogen bonds, parallel to the helix axis, occurring between NH and C=O groups

**Question No.71**

Monoclonal antibodies have been effective tools to diagnose different cancers. Increasingly they are used for therapy. Which antibodies have shown great promise in the treatment of metastatic melanoma?

- Checkpoint blockade inhibitors (CTLA-4, PD1)
- Anti-lymphocyte antibodies (CD20, CD52)
- Anti-vascular endothelial growth factor receptor (VEGFR2)
- Anti-epidermal growth factor receptor (HER-2)

**Question No.72**

Which of the following cell types mediates adaptive immune responses?

- Lymphocyte
- Natural Killer cell
- Dendritic cell
- Macrophage

**Question No.73**

Which of the following is an equilibrium method that can be used to accurately determine DNA-protein dissociation constants?

- Chromatin Immunoprecipitation
- Site directed mutagenesis
- EMSA
- Foot printing

**Question No.74**

What is the function of the protein?

- Storage of genetic information
- Cell membranes and energy storage
- Structural support and energy storage
- Structural and biochemical

**Question No.75**

Why the peptide bonds adopt planar geometry in proteins?

- Due to hydrogen bonding

- Due to steric hinderance
- Due to the cis configuration of the peptide bond
- Due to the carbon-nitrogen partial double bond

**Question No.76**

What would be the likely explanation for the existence of pseudogenes?

- Unequal crossing over
- Gene duplication and mutation events
- Mutation events
- Gene duplication

**Question No.77**

What is the first event which happens to a growth factor / cytokine receptor after binding its cognate signal molecule?

- Binding of signal causes the receptor to pick up a tyrosine kinase from the cytoplasm
- Binding of signal causes tyrosines in the receptor's C-terminal tail to become phosphorylated.
- Binding of signal activates the receptor's cytoplasmic tyrosine kinase domain.
- Binding of signal causes receptors to dimerise

**Question No.78**

Which mediator can lead to systemic inflammation?

- Interleukin 10
- Interferon gamma
- Interferon alpha
- Tumour Necrosis factor alpha

**Question No.79**

Which effectors can eradicate parasites?

- Eosinophil
- Neutrophils
- Complement
- Macrophages

**Question No.80**

What is the term used to find the evolutionary history and relationship of an organism or group of organisms?

- Proteome
- Phylogeny
- Taxonomy
- Biodiversity

**Question No.81**

Two solutions of substances are mixed with in the following manner. 400 mL of 2 M first solution + 600 mL of 1.5 M second solution. What is the molarity of the final mixture?

- 2.68 M
- 1.55 M
- 1.7 M
- 3.4 M

**Question No.82**

What is DNA ligase?

- An enzyme, which cuts DNA at specific base sequences
- An enzyme, which facilitates the joining of DNA
- An enzyme involved in transcription of specific genes
- An enzyme involved in protein synthesis

**Question No.83**

How does the mismatch repair system distinguish between the parental (i.e. correct) DNA strand and the newly synthesised strand containing the mismatched base?

- Guanine in the new strand of the helix is methylated at GATC.
- Guanine in the parental strand of the helix is methylated at GATC.
- Thymine in the parental strand of the helix is methylated at GATC.
- Thymine in the new strand of the helix is methylated at GATC

**Question No.84**

ESTs are obtained through:

- Chromosome walking
- RT-PCR
- cDNA library
- Genomic DNA library

**Question No.85**

Which alignment is useful to detect the highly conserved regions?

- Local
- Global
- Pairwise sequence
- Multiple sequence

**Question No.86**

What are the pathways involved in the process of coagulation?

- Intrinsic and final common path ways
- Extrinsic and final common path ways
- Intrinsic and extrinsic pathways
- Intrinsic, extrinsic, and final common pathways

**Question No.87**

What is the missing number if  $36 \rightarrow 29$ ,  $24 \rightarrow 26$ ,  $18 \rightarrow 89$ , then  $26 \rightarrow ?$

- 38
- 24
- 18
- 32

**Question No.88**

To produce five glucose molecules, how many numbers of ATP and NADPH molecules are required?

- 90, 60
- 9, 12
- 45, 30
- 36, 60

**Question No.89**

Genes related through descent from a common ancestral gene are called

- Paralogous
- Homologous
- Heterologous
- Orthologous

**Question No.90**

Which one of the following analytical method is better to identify, whether the given compound is monomer, dimer or trimer?

- Electrospray Ionization Mass Spectroscopy
- Matrix-Assisted Laser Desorption Ionization spectroscopy
- Infra-Red Spectroscopy
- Nuclear Magnetic Resonance Spectroscopy

**Question No.91**

A population of cells grown in adherent culture contains 0.4 mg protein per  $10^6$  cells. Actin comprises 4.5 % of the total protein. Given the Mr of actin is 42 000 and Avogadro's number is  $6.02 \times 10^{23}$ , which of the following equals the mean number of actin molecules per cell?

- $2.58 \times 10^{10}$  actin molecules
- $2.58 \times 10^{14}$  actin molecules
- $2.58 \times 10^{11}$  actin molecules
- $2.58 \times 10^8$  actin molecules

**Question No.92**

Which chemical reagent is used to reduce the S-S bonds formed between cysteine residues?

- Pepsin
- Trypsin
- 2-nitro-5-thiocarbanobenzoate
- 2-mercaptoethonal

**Question No.93**

How many orbitals are allowed for principal quantum number  $n=5$ ?

- 6
- 25
- 10
- 5

**Question No.94**

The genomic DNA fraction which has highest value of  $\text{cot } \frac{1}{2}$  on Cot curve represents:

- Moderately repetitive DNA
- Highly repetitive DNA

- Unique DNA
- Minisatellite DNA

**Question No.95**

Long terminal repeats are found in

- Influenza virus
- Proviral DNA
- Reoviral genome
- Retroviral RNA

**Question No.96**

Which tool compares protein sequence against translated nucleotide databases?

- blastp
- tblastn
- tblastx
- blastn

**Question No.97**

Which one of the following tests will you conduct to determine the absence of PSII from plant's chloroplast?

- Presence of oxygen in light
- Fixation of CO<sub>2</sub> in dark
- Presence of thylakoid in the chloroplasts
- Presence of sugar

**Question No.98**

What is FlyBase?

- A database of Drosophila genes and genomes
- A 3D structural database of proteins and nucleic acids
- A literature database contains articles about fruit flies
- A database on biomedical research

**Question No.99**

In bacterial promoters, which of the following describes the 'Pribnow box'?

- The -35 box
- The 5' untranslated region
- The -10 box
- The termination sequence

**Question No.100**

An activated Natural killer (NK) cell can kill a cell expressing:

- MHC class II and an NK cell ligand
- An NK cell ligand
- Absent MHC class I and an NK cell ligand
- MHC class I and an NK cell ligand