## Section A

1. Virus-mediated transfer of cellular genetic material from one bacterial cell to another by means of virus particles is called:
   (a) Transduction
   (b) Transposition
   (c) Transformation
   (d) Transfection

2. The plasmid cloning vector pBR322 contains ampR and tetR genes that confer resistance to ampicillin and tetracycline, respectively. The tetR gene contains a site for the restriction endonuclease BamHI. pBR322 is first cleaved with BamHI, added to a BamHI restriction fragment from a different DNA molecule and the resulting mixture is treated with DNA ligase and used to transform E. coli cells. Under these conditions, which one of the following statements is TRUE?
   (a) Tetracycline can then be used to select for transformed E. coli carrying recombinant plasmids.
   (b) Tetracycline can then be used to select for transformed E. coli carrying non-recombinant plasmids.
   (c) Tetracycline can then be used to select for non-transformed E. coli.
   (d) E. coli cells with recombinant plasmids will grow on both tetracycline and ampicillin.

3. Which subunit of *E. coli* RNA polymerase is responsible for gene selection?
   (a) Alpha
   (b) Beta
   (c) Omega
   (d) Sigma

4. Which one of the following radioisotopes **DOES NOT** emit β rays?
   (a) $^{14}C$
   (b) $^{3}H$
   (c) $^{32}P$
   (d) $^{125}I$

5. Which of the statements about tRNAs is **FALSE**?
   (a) All organisms have more than 20 tRNA genes.
   (b) The three-dimensional structure of tRNAs looks like a cloverleaf.
   (c) tRNAs contain modified bases.
   (d) The sequence of the last 3 nt at the 3' end of all tRNAs is the same.

6. Collagen consists of 3 helical chains containing Glycine and proline amino acids in each chain. The overall structure of each polypeptide in the collagen molecule is a:
   (a) Polyproline I
   (b) Polyproline II
   (c) α–helix
   (d) Polyglycine I

7. In nuclear magnetic resonance (NMR) spectroscopy, the absorption spectra result by the absorption of one of the following electromagnetic radiation by the spinning nucleus:
   (a) Ultraviolet waves
   (b) Infrared waves
   (c) Radio waves
   (d) Microwaves

8. A ribonuclease solution gave an absorbance of 1.0 at 278 nm in a UV spectrometer using a 1 cm quartz cuvette. Given that the molar extinction coefficient of the enzyme at 278 nm is 102 M-1cm-1, the concentration of the enzyme would be:
   (a) 1 mM
   (b) 20 mM
   (c) 10 Mm
   (d) 100 mM

9. Two proteins have the same molecular mass as well as the same isoelectric point. The best way to separate them would be to use:

(a) Reverse phase chromatography.
(b) Gel filtration chromatography.
(c) Ion-exchange chromatography.
(d) Chromatofocusing.

10. One strand of double-stranded DNA is mutated, changing all cytosines to uracils. After one round of replication of the mutated DNA strand, the melting temperature of the resulting DNA will:
(a) Be higher
(b) Be lower
(c) Remain the same
(d) Be double

11. Which type of restriction enzymes **DOES NOT** require ATP?
(a) Type I
(b) Type II
(c) Type III
(d) Type IV

12. The Southern blotting technique is used for:
(a) The detection of RNA fragments on membranes by specific radioactive antibodies.
(b) The detection of DNA fragments on membranes by a radioactive DNA probe.
(c) The detection of proteins on membranes using a radioactive DNA probe.
(d) The detection of DNA fragments on membranes by specific radioactive antibodies.

13. Which of the following is **NOT** found in an E. coli replication fork?
(a) DnaA
(b) Primase
(c) PCNA
(d) Single-stranded DNA binding protein.

14. Which of the following is changing the fastest over evolutionary time?
(a) The amount of intergenic DNA.
(b) The order of genes on chromosomes.
(c) Microsatellites.
(d) Exon DNA sequences.

15. Superoxide dismutase is an important enzyme for maintenance of red blood cells and is defective in some neurodegenerative diseases. What does this enzyme do?
(a) Catalyzes the conversion of $O_2$ – to $H_2O_2$ and $O_2$.
(b) Creates superoxides by oxidizing heme.
(c) converts $H_2O_2$ to water and $O_2$.
(d) removes $H_2O_2$ by oxidizing glutathione and producing water.

16. Which of the following conditions would **NOT** promote denaturation of double-stranded DNA?
(a) Heating to 100 degrees Celsius.
(b) Adding high concentrations of sodium citrate.
(c) Decreasing the ionic strength of the solution.
(d) Adding a protein that binds to single stranded, but not to double-stranded DNA.

17. Carboxymethyl cellulose is:
(a) A cation -exchange matrix.
(b) A gel filtration matrix.
(c) An anion-exchange matrix.
(d) A plant cell wall constituent.

18. Biological washing powders remove stains by enzyme action. Which of the following combinations would be most effective in removing an egg stain?
(a) Amylase and protease.
(b) Catalase and lipase.
(c) Lipase and maltase.
(d) Lipase and protease.

19. A tetanus booster shot results in the increased production of:
    (a) Tetanus-specific NK cells.
    (b) T cells that recognize tetanus toxoid but not tetanus toxin.
    (c) Antibodies which neutralize tetanus toxin.
    (d) T-cells which kill Clostridium tetani.

20. Allotypes are:
    (a) Antigenic determinants which segregate within a species.
    (b) Critical to the function of the antibody combining site.
    (c) Involved in specificity.
    (d) Involved in memory.

21. ELISA:
    (a) Results in cell lysis.
    (b) Uses a radiolabelled second antibody.
    (c) Involves addition of substrate which is converted to a colored end-product.
    (d) Requires sensitized red blood cells.

22. Which of the following is **NOT** a member of the Immunoglobulin supergene family?
    (a) Antibodies.
    (b) Lymphokines.
    (c) TCR.
    (d) Fc receptor on leukocytes.

23. Exchange of two non-homologous chromosomes is known as:
    (a) Crossing over
    (b) Reciprocal translocation
    (c) Inversion
    (d) Duplication

24. ESTs are obtained through:
    (a) Genomic DNA library
    (b) cDNA library
    (c) RT-PCR
    (d) Chromosome walking

25. Targetted suppression of gene expression is achieved by:
    (a) T-DNA insertion
    (b) EMS
    (c) RNAi
    (d) Gamma ray

26. A set of two or more overlapping DNA fragments that form a contiguous stretch of DNA is called:
    (a) Contigs
    (b) BAC clones
    (c) YAC clones
    (d) Map

27. A vector can accept an insert of 20 kb size and the recombinant vector can be replicated in E. coli. In order to make complete gene library of E. coli by using this vector, minimum number of bacterial colonies which must be present should **NOT** be less than:
    (a) $1.1 \times 10^3$
    (b) $4.1 \times 10^3$
    (c) $2.1 \times 10^4$
    (d) $1.5 \times 10^4$

28. Scientist involved with "Golden Rice" technology is:
    (a) Norman Borlaug
    (b) I. Potrykus
    (c) M.S. Swaminathan

(d) G.S. Khush

29. Haploid production by anther culture was first demonstrated by:
    (a) Bhojwani.
    (b) Guha and Maheshwari.
    (c) Murashige and Skoog.
    (d) Cocking.

30. The DNA of temperate phage P4 is linear, double stranded, 11.5 kb long and has cohesive ends. Digestion with BamH1 yields fragments 6.4, 4.1 and 1.0 kb in length. The partial digestion with the same enzyme yields fragments 10.5, 7.4, 6.4, 4.1, and 1.0 kb in length. Circular P4 DNA made with DNA ligase can be digested with BamH1 to yield fragments in the DNA. What is the order of fragments in DNA?
    (a) 6.4- 1.0- 4.1
    (b) 4.1- 6.4- 1.0
    (c) 1.0- 6.4- 4.1
    (d) 4.1- 1.0- 6.4

31. The peptide bond is rigid because it is a:
    (a) Single bond
    (b) Partial double bond
    (c) Double bond
    (d) Triple bond

32. If we increase the confidence limits then:
    (a) No change in significant result.
    (b) Statistically significant result may change to non-significant.
    (c) Non-significant result may change to significant result.
    (d) No change in level of significance.

33. A woman has a color blind father but husband with normal vision. What are the chances for their sons and daughters to be color blind?
    (a) ½ for sons; ½ for daughters.
    (b) ¼ for sons; ¾ for daughters.
    (c) ½ for sons; zero for daughters.
    (d) Zero for sons; ¾ for daughters.

34. An isolated human population, with approximately equal number of blue eyed and brown eyed individuals, was killed due to earthquake. Only a few brown eyed people remained to form the next generation. This kind of change in the gene pool is called:
    (a) Hardy- Weinberg equilibrium.
    (b) blocked gene flow.
    (c) bottleneck effect.
    (d) founder effect.

35. Cystic fibrosis is due to:
    (a) Defective chloride channel.
    (b) Defective LDL receptor.
    (c) High levels of HDL.
    (d) Increased dopamine.

36. HAT selection is based on:
    (a) TK and HPRT genes.
    (b) APRT and ATK genes.
    (c) HK and AP genes.
    (d) HAT gene.

37. The main difference between active transport and facilitated diffusion is that:
    (a) In active transport, the molecules move from areas of high concentration to areas of low concentration
    (b) Carrier protein is involved only in case of active transport.
    (c) In active transport, energy is consumed to move molecules against a concentration gradient.
    (d) In active transport, only water molecules are transported.

38. What is the CORRECT order of molecular weights?
    (a) Human antibody>albumin>insulin>glutathione.
    (b) Albumin>insulin>antibody>glutathione.
    (c) Glutathione>insulin>albumin>antibody.
    (d) Insulin>antibody>glutathione>albumin.

39. Beaker A has 100 ml of a fluid at 800C and beaker B has 200 ml of the same fluid at 200C. If both the fluids are mixed, what would be the resultant temperature of the mixture?
    (a) $20^0$C
    (b) $80^0$C
    (c) $40^0$C
    (d) $50^0$C

40. During batch fermentation lowest specific growth rate is achieved during:
    (a) Exponential phase.
    (b) Lag and stationary phase.
    (c) When cells are growing at their fastest pace.
    (d) Throughout the fermentation.

41. In competitive inhibition:
    (a) Km increases, V max constant.
    (b) Km decreases, Vmax constant.
    (c) Km constant, Vmax increases.
    (d) Km decreases, Vmax increases.

42. For a reaction to be spontaneous,
    (a) $\Delta G$ is negative
    (b) $\Delta G$ is positive
    (c) $\Delta G = 0$
    (d) $\Delta H$ increases

43. The dependence of molecular weight of protein molecule to the distance traveled in denaturing gel electrophoresis is:
    (a) Linear.
    (b) Cubic.
    (c) Logarithmic.
    (d) Inversely related to the amount of denaturant.

44. Addition of salt to a culture medium only allows the salt-tolerant bacteria to grow. This is an example of a:
    (a) Complex media
    (b) Chemically defined media
    (c) Selective media
    (d) Differential media

45. Long terminal repeats are found in:
    (a) Proviral DNA
    (b) Retroviral RNA
    (c) Reoviral genome
    (d) Influenza virus

46. A signal sequence KDEL is removed from a ER resident protein. Assuming that there is no change in tertiary structure of protein and on other signal sequences present in protein, the changed protein will now have following fate:
    (a) It will remain in ER and be degraded.
    (b) It will be targeted to Golgi apparatus.
    (c) It will be secreted outside the cell.
    (d) It will be targeted to lysosome for degradation.

47. "All living cells arise from preexisting cells" was proposed in cell theory by:
    (a) Schleiden and Schwann.

(b) Rudolf Virchow.
(c) Dutrocht.
(d) Pasteur.

48. Using deliberate attenuation approach Louis Pasteur Produced vaccine against which diseases?
(a) Rabies
(b) Tuberculosis
(c) Anthrax
(d) FMD

49. What is PROSITE?
(a) A database of protein structures.
(b) A database of interacting proteins.
(c) A database of protein motifs.
(d) A search tool.

50. Which is the best annotated database?
(a) Genbank
(b) PDB
(c) Prodom
(d) Swissprot

## Section B

51. Protein sequence comparison is more sensitive than nucleic acid sequence comparison because:
(a) Proteins are functional.
(b) Proteins have definite three-dimensional structures.
(c) The protein alphabet has more letters than the nucleic acid.
(d) Codon bias.

52. Sickle-cell anemia is an example of Single Nucleotide Polymorphism (SNP) of:
(a) A to T mutation
(b) T to A mutation
(c) G to C mutation
(d) C to G mutation

53. Which of the statements about translation is **FALSE**?
(a) During translocation in the "hybrid sites" model, the tRNA attached to the nascent polypeptide chain is in the P site of the small subunit and the A site of the large subunit.
(b) Fusidic acid prevents the release of EFG- GDP from the ribosome.
(c) Puromycin leads to premature release of the polypeptide chain.
(d) IF-3 preferentially binds to 30S ribosomes.

54. For the folding of a linear polypeptide into a compact tertiary structure, globular in nature, the change in entropy is known to be negative. In order for the folding process to be thermodynamically feasible, the overall change is enthalpy based in intermolecular interaction should be:
(a) +Ve
(b) -Ve
(c) Zero
(d) Endothermic

55. If the equilibrium constant for a chemical reaction at 20 ?? C is 20, the standard free energy change associated with the reaction will be:
(a) -1.74 kcals
(b) 1.74 kcals
(c) 0.76 kcals
(d) 0.12 kcals

56. Cyclic adenosine monophosphate (cAMP) regulates the lactose (lac) operon by:

(a) Binding to the operator to turn on transcription.
(b) Binding to the lac repressor to prevent transcription.
(c) Combining with the catabolite activator protein (CAP) to form a complex that enhances transcription upon binding to the promoter.
(d) Combining with the CAP to remove CAP's inhibition of transcription.

57. Co-transport of nutrients across the intestinal cell membranes is an active process that can move glucose against a concentration gradient. The energy requiring step for co-transport involves:
(a) The $Na^+K^+$ ATPase that pumps $Na^+$ from the cell into the lumen of the intestine.
(b) The permease that allows glucose and $Na^+$ into the cell requires ATP.
(c) The permease that pumps glucose from the cell into the blood requires ATP.
(d) The $Na^+K^+$ ATPase that pumps $Na^+$ from the cell into the blood, maintaining low Na+ levels in the cell.

58. The endogenous GTPase activity of G-proteins serves to:
(a) Stimulate the activity of enzymes by producing energy.
(b) Synthesize cGMP as a second messenger.
(c) Synthesize GTP as an energy source.
(d) Hydrolyze GTP returning the G protein to a pre-stimulated level of activity.

59. Cytochalasins are drugs that interfere with actin polymerization into microfilaments. If you add cytochalasin to cultured mammalian cells that have just begun mitosis what is most likely to happen?
(a) The cells will arrest at mitotic metaphase.
(b) The cells will cease metabolism and die.
(c) The cells will complete mitosis and arrest at cytokinesis.
(d) The cells will arrest at mitotic anaphase.

60. Which of the following is **NOT** a part of the methods used in single locus probe analysis of VNTR regions of human DNA?
(a) DNA extraction.
(b) Restriction endonuclease digestion of DNA.
(c) Gel electrophoresis.
(d) Recombinant DNA.

61. Which of the following elements is **NOT** a characteristic of factor independent terminators in *E.coli*?
(a) A C-rich sequence.
(b) An RNA sequence that can form a stem-loop.
(c) A run of single-stranded U residues.
(d) A GC rich sequence.

62. A covalently closed circular DNA containing a single promoter is mixed with RNA polymerases that open complexes form where 1 turn of DNA is unwound. Which of the following statements will be TRUE? Please note that L = linking number, T = twist, and W = writhe.
(a) L will decrease because T will decrease by 1.
(b) L will increase because W will increase by 1.
(c) L will stay the same because T and W will not change.
(d) L will stay the same because an increase in W will cancel out the decrease in T.

63. The RNA from the ribosomes of *E. coli* has a GC content of 51%. After infection with a phage that has a GC content of 40%, you purify the RNA, and run it on a density gradient, which gives you peaks at 23S, 16S, and 4S, plus a high baseline between the 23S and 16S peaks. Which of the following would you expect to see from the analysis of the GC content of each fraction?
(a) All the RNA will be 40% GC.
(b) The RNA in the 4S peak will be 40%GC, but everything else will be 51%GC.
(c) The RNA in the 23S, 16S and 4S peaks will be 51%GC, but the material between 16S and 23S will be 40%GC.
(d) The RNA in the 23S, 16S an 4S peaks will be 40%GC, but the material between 16S and 23S will be 51%GC.

64. Which of the following statements about tumor suppressors is TRUE?
(a) Tumor suppressors are mutant tRNAs that recognize stop codons.
(b) Tumor suppressors are mutated viral versions of cellular proteins involved in signal ransduction.

(c) Recessive mutations that inactivate the Rb tumor suppressor are found in families with high incidence of retinoblastomas.
(d) Viral oncogenes can act by increasing the activity of cellular tumor suppressor p53.

65. The insulin receptor functions as a:
(a) Receptor with 7 transmembrane spanning regions.
(b) Nuclear protein that acts as a transcription factor.
(c) Receptor guanylate cyclase.
(d) Tyrosine kinase.

66. Frameshift mutations are observed because the DNA code is:
(a) Comma-less
(b) Redundant
(c) Anti-parallel
(d) Degenerate

67. When synthetic mRNA consisting of alternating A and C residues (ACACAC....) was translated in a bacterial extract, only one kind of polypeptide consisting of alternating threonine and histidine residues was made. When the base sequence was ...AACAACAAC.... three different polypeptides were formed :poiyasparagine, polythreonine and polyglutamine. Hence we may conclude that one codon for histidine is:
(a) ACA
(b) CAC
(c) AAC
(d) CAA

68. Hybrid dysgenesis is asymmetrical. It is induced by:
(a) X male PM crosses.
(b) P male x M female crosses.
(c) M male x P female crosses.
(d) it is a random event, can occur in all the three.

69. During RNA polymerase II transcriptional initiation, phosphorylation of the following factor is essential to commence transcription:
(a) Polymerase II CTD
(b) TFIID
(c) TFIIH
(d) TFIIE

70. Typical nucleosomal organization of a gene is **NOT** found in:
(a) Human liver nuclei
(b) Malarial parasite
(c) Human sperm
(d) Neuron

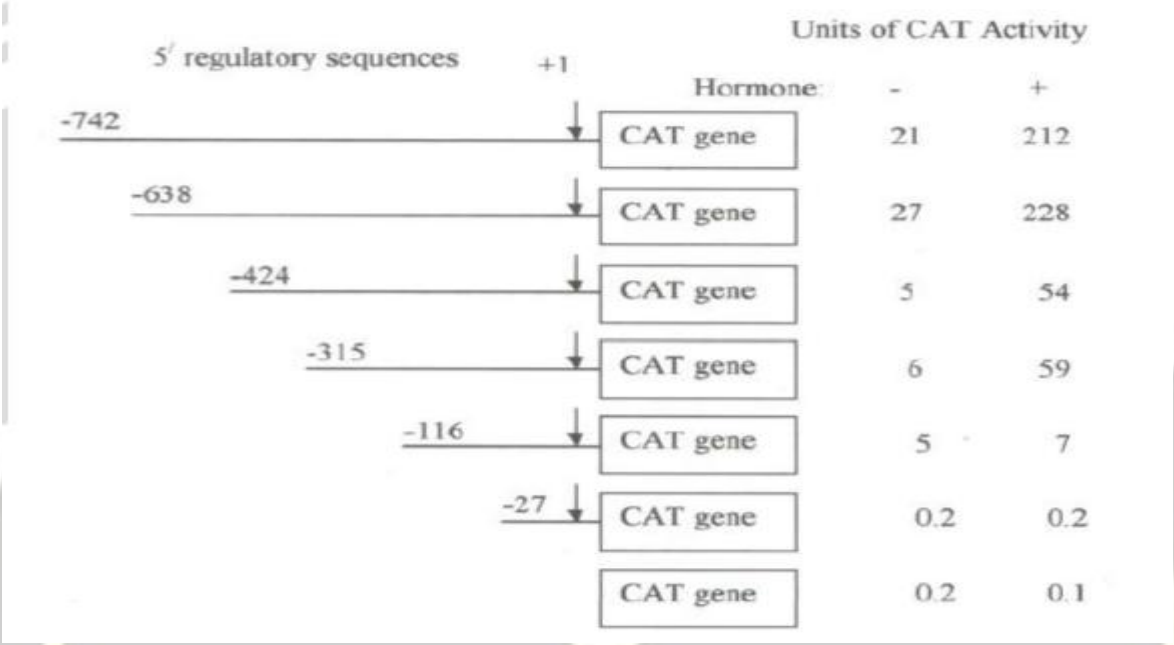
71. A mutational event inserts bases in the beginning of the coding sequence of a gene. The highest chance of the altered protein being functional when the number of base(s) inserted is:
(a) 1
(b) 2
(c) 3
(d) 4

72. In a temperature sensitive mutant bacteria, at non-permissive temperature, there are huge accumulation of Okazaki fragments. The bacteria are mutant for:
(a) DNA polymerase I
(b) DNA topoisomerase I
(c) DNA ligase
(d) DNA gyrase

**Answer questions 73-75 based on the information provided below:**

Researchers studying the regulation of a hormone-responsive gene isolated 750 base pairs of DNA immediately preceding the start site of transcription (+ 1). They demonstrated that if these sequences are

cloned upstream of the bacterial chloramphenicol acetyltransferase (CAT) gene and the DNA then introduced into mammalian cells, CAT enzyme activity increases in response to hormone treatment. To define the sequences involved in the regulation of this gene, they made a series of deletions containing various lengths of the 5/ regulatory sequences. They cloned these truncated DNA fragments upstream of the CAT gene as shown in the figure below, introduced the constructs into the mammalian cells, and assayed for the CAT enzyme activity in the absence (-) and presence (+) of hormone. The figure below gives the results of a representative experiment.




73. The maximal stimulation of CAT activity due to the addition of hormone is approximately:
    (a) 1-fold
    (b) 10-folds
    (c) 50-folds
    (d) 100-folds

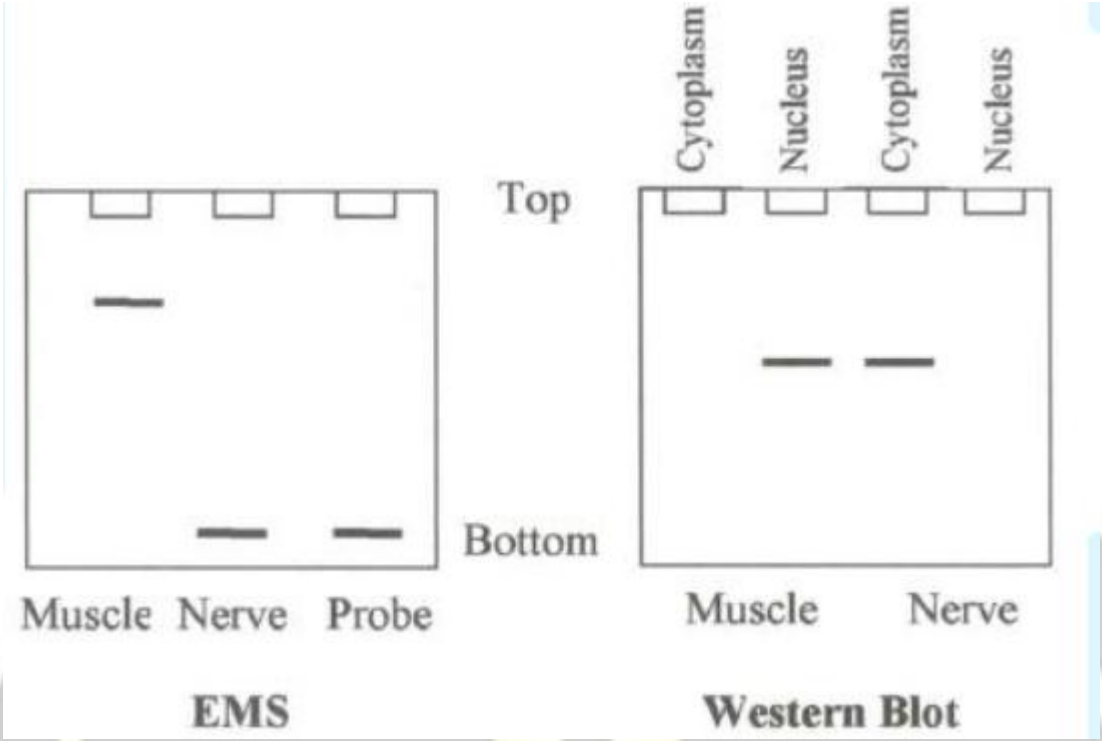
74. Assuming that there is a single hormone responsive regulatory element in the gene, that element is located between:
    (a) -742 and 638
    (b) -638 and -424
    (c) -424 and -315
    (d) -315 and -116

75. A new construct was made that began at - 742 and was identical to that shown in the figures except that the sequences between - 424 and -315 were inverted. In this new construct, which of the following are closest to the expected CAT activities in the absence and presence, respectively, of hormones?
    (a) 5 units/50 units
    (b) 5 units/25 units
    (c) 25 units/10 units
    (d) 25 units/5 units

**Answer questions 76-78 based on the information provided below:**

A transcription factor Y (TFY) is examined for its DNA binding ability and its expression in different cell lines. The specific DNA binding sequence has been determined and is used as a probe in an electromobility shift (EMS) assay

Specific antibody against TFY is used in Western blot analysis to check the subcellular localization of the protein. The EMS and Western blot results of TFY activity in muscle cells and nerve cells are shown below.




76. The EMS results suggest that:
    (a) TFY is expressed only in the muscle cells.
    (b) TFY binds DNA in the muscle cells, but not in nerve cells.
    (c) TFY binds DNA in the nerve cells, but not in muscle cells.
    (d) TFY is expressed only in the nerve cells.

77. According to the results of the Western blot,
    (a) TFY binds with DNA in nerve cells.
    (b) TFY is expressed only in muscle cells.
    (c) TFY is expressed both in nerve and muscle cells.
    (d) TFY binds with DNA in muscle cells.

78. It was observed that TFY activity is significantly blocked in the nerve cells in comparison to muscle cells. Based on these data, what could be most likely mechanism of regulation of TFY in nerve cells?
    (a) Inhibition of transcription of TFY in the nucleus.
    (b) Inhibition of translation of TFY in cytoplasm.
    (c) Inhibition of translocation of TFY to the nucleus.
    (d) Inhibition of translocation of TFY to the cytoplasm.

79. Which of the following is not CORRECT pair of a metabolic pathway and its subcellular location?
    (a) Oxidative phosphorylation occurs in mitochondria.
    (b) Fatty acid synthesis occurs in mitochondria.
    (c) Ganglioside degeneration occurs in lysosomes.
    (d) Glycolysis occurs in mitochondria.

80. A solution of a protein whose sequence includes three tryptophan residues, no tyrosine residues, and no phenylalanine residues has an absorbance of 0.3 at 280 nm in a cell with a path length of 1 cm. Estimate the concentration of the protein in units of molarity. If the protein has a molecular mass of 100 kDa, estimate the concentration in units of milligrams of protein per millilitre of solution. ($\varepsilon$= 10000 $M^{-1}$ $cm^{-1}$):
    (a) 10 µM, I mg/Ml
    (b) 30 µM, 1 mg/mL
    (c) 30 µM, 3 mg/mL
    (d) 10 µM, 3 mg/mL

81. Repolarization after an action potential occurs:

(a) Through the opening of $Na^+$ channels.
(b) Through the opening of $Na^+$ and closure of $K^+$ channels.
(c) Through the closure of $Na^+$ and opening of $K^+$ channels.
(d) Through the opening of $Na^+$ and K+ channels.

82. Chitosan, a derivative of chitin isolated from Shrimps and marine crustaceans is being used as a tool for drug and vaccine delivery. It is a polymer of:
(a) Acetylated β-(1-4)-linked D-glucosamine.
(b) Acetylated N-acetyl-D-glucosamine.
(c) Deacetylated β-(1-4)-linked Glucosamine.
(d) Acetylated β-(1-4)-linked D-glucosamine and acetylated N acetyl- D- glucosamine.

83. The gene that increases susceptibility to breast cancer is:
(a) p53
(b) BRCA-1
(c) Rb-1
(d) H-Ras

84. In the urine of Burkitt's lymphoma patient abnormal quantities of the following is detected:
(a) Bence-Jones Proteins.
(b) Human Chorionic Gonadotrophin (hCG).
(c) Carcinoembryonic antigen (CEA).
(d) Alpha-fetoprotein (AFP).

85. What would be the functional consequence for the immune system in a knock out mice lacking 2 microglobulin?
(a) Loss of TCR expression.
(b) Loss of phagocytic ability.
(c) Loss of structural integrity of MHC II.
(d) Loss of structural integrity of MHC I.

86. Frequent development of primary tumours of reticuloendothelial system is due to:
(a) Acquired haemolytic anemia
(b) Hypergammaglobulinemia
(c) Corticosteroid abuse
(d) Impairment of CMI

87. Negative selection of T-cells depends on:
(a) High affinity to self antigen.
(b) High affinity to thymosin.
(c) Intermediate affinity to self antigen.
(d) Low affinity to self MHC.

88. Hemophilia A, a common X-linked bleeding disorder is caused due to lack of function of a gene for:
(a) Factor VIII
(b) Factor VII
(c) Platelets
(d) Fibrinogen

89. Which one of the following statements is TRUE for mitochondrial disease?
(a) Heteroplasmy.
(b) Mitochondrial gene mutates less often than nuclear gene.
(c) Mitochondrial conditions only affect muscle and nerve tissue.
(d) The risk of passing on a mitochondrial condition to the next generation may be as high as 100%.

90. Immuno-suppression is mediated by T-cells having:
(a) $CD4^+CD25^-$
(b) $CD8^+CD25^-$
(c) $CD8^+CD25^+$
(d) $CD4^+CD25^+$

91. The target cells for ADA gene therapy are:
    (a) Bone marrow cells
    (b) B-lymphocytes
    (c) Liver cells
    (d) Spleen cells

92. All of the following are angiogenic factors EXCEPT:
    (a) VEGF
    (b) Ang-1
    (c) Endostatin
    (d) Cox-2

93. Acute graft versus host disease is mediated by:
    (a) Helper T cells
    (b) Cytotoxic T cells
    (c) NK Cells
    (d) B cells

94. All of the following disorders can be diagnosed prenatally by chorionic villus sampling, EXCEPT:
    (a) Downs syndrome
    (b) Alpha thalassemia
    (c) Tay Sach's disease
    (d) Spina bifida

95. The germ layer that produces nervous system is:
    (a) Endoderm
    (b) Mesoderm
    (c) Ectoderm
    (d) Endoderm and mesoderm

96. The rate of impulse conduction in a nerve depends on:
    (a) Axon diameter and axon length.
    (b) Axon length and number of dendrites.
    (c) Axon diameter and thickness of myelination.
    (d) Myelination and nuclear size.

97. Pain sensation is a subjective and conscious feeling. However, although the autonomic organs do not get represented in the cerebral cortex, one feels pain in those parts as well. The reason is:
    (a) Those parts receive less blood supply.
    (b) Increased pH in those parts.
    (c) The pain is referred to other parts of the body.
    (d) Those organs are not superficially located.

98. Which one of the following is **NOT** a function of glia?
    (a) Providing support to the neural tissue.
    (b) Conduction of electrical signal.
    (c) Myelination of neurons.
    (d) Help in neuronal growth.

99. At chemical synapse, communication between two neurons is:
    (a) Physical process.
    (b) Chemical process.
    (c) Physico-chemico-physical process.
    (d) Physico-chemico-mechanical process.

100. Retrograde transport may be used for :
    (a) Nerve path tracing
    (b) Determining nerve fiber diameter
    (c) Determining soma size.
    (d) Estimating number of dendrites.

101. Which of these electrodes will be preferred for intracellular potential recording?
(a) Glass capillary electrode
(b) Steel micro-electrode
(c) Copper micro-electrode
(d) Solid glass electrode

102. Which of the following types of neurons may be identified using Tyrosine hydroxylase immunostaining?
(a) Cholinergic
(b) GABA-ergic
(c) Glutamateric
(d) Aminergic

103. Nerve is a bundle of fibres. In vertebrates it contains:
(a) Many myelinated axons of different diameters as well as large number of unmyelinated fibres.
(b) Many unmyelinated fibres as well as large number of myelinated axons of same diameter.
(c) Only myelinated axons of same diameter.
(d) Only unmyelinated axons of different diameter.

104. In a neuronal culture experiment the response gradually reduced when the neurons were exposed to increasing concentration of a chemical. However, if the cells were thoroughly washed and left for sometime in normal medium and then the experiment was repeated, the cells started responding similarly as before. Which of the following could be the most probable explanation?
(a) Increased apoptosis of the cells.
(b) The cells were gradually necrosed in an exponential manner.
(c) The pH of the medium was changed.
(d) The receptors were desensitized/down-regulated.

105. Under a condition (A) a neuron showed transmembrane potential -50mV while after some treatment (B) it was -70mV. Given such a condition, which of the following statements would be CORRECT?
(a) Condition (A) is hyperpolarized state than condition (B).
(b) Condition (A) needs higher intensity stimulation than condition (B) for inducing a response.
(c) The treatment caused depolarization of the neuron.
(d) The treatment induced hyperpolarization.

106. Which of the statements is TRUE for matured human RBC? It
(a) Divides once a day.
(b) Does not divide.
(c) Divides every 120 days.
(d) Divides under stressful condition.

107. The intervention by which a gadget e.g. an electrode may be accurately guided to a predefined region deep inside the brain is known as:
(a) Stereoscopy
(b) Stereotaxic surgery
(c) Craniotomy
(d) Laparoscopy

108. Hybridization between species followed by polyploidy or chromosome doubling is known as:
(a) Autopolyploid
(b) Aneuploid
(c) Haploid
(d) Allopolyploid

109. Identify the hormone combination that induces shoot development in vitro:
(a) No auxin + average cytokinin.
(b) High auxin + no cytokinin.
(c) High auxin + low cytokinin.
(d) Low auxin + high cytokinin.

110. C4 rice has been developed by transforming rice with:
(a) PCPC

(b) PPDK
(c) GS
(d) Both PEPC and PPDK

111. Stress signalling is mediated by:
(a) ABA
(b) GA
(c) Both the above
(d) None of the above

112. The first commercially released GM crop in India is:
(a) Cotton expressing cryIAb gene.
(b) Brinjal expressing cry1Ab gene.
(c) Corn expressing cryIAb gene.
(d) Cotton expressing cryIAc gene.

113. Biodiesel is produced by:
(a) Transesterification
(b) Fermentation
(c) High pressure oxidation
(d) Esterification

114. 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:
(a) Homologous genes
(b) Orthologous genes
(c) Paralogous genes
(d) Isoforms

115. Vitrification of cultured explants caused by:
(a) Low light irradiance, high temperature and intensive sterilization.
(b) High auxin, low temperature and high light irradiance.
(c) Higher agar, high nutrients and low pH.
(d) High pH, low temperature and high micronutrient concentration.

116. Which of the following objectives **CANNOT** be achieved through use of cybrids?
(a) Transfer of cytoplasmic male sterility.
(b) Recombination of cytoplasmic genes with nuclear gene of another species.
(c) Introgression of Chromosome segment.
(d) Development of true hybrid line.

117. The most preferred choice for development of hybrid plants from a male sterile line would be:
(a) Pollen culture
(b) Anther culture
(c) Ovary culture
(d) Meristem culture

118. The transplastomic lines bear no risk of gene escape through pollens because:
(a) Pollens degenerate before fertilization.
(b) Transformed mitochondrial DNA is lost during pollen maturation.
(c) Transformed chloroplast DNA is lost during pollen maturation.
(d) Transformed genomic DNA is maternally inherited.

119. A cross between two true breeding lines one with dark blue flowers and one with bright white flowers produces F1 offspring that are light blue. When the F1 progeny are selfed a 1:2:1 ratio of dark blue to light blue to white flowers is observed) What genetic phenomenon is associated with these results?
(a) Epistasis
(b) Incomplete dominance
(c) Co-dominance
(d) Inbreeding depression

120. Mutations which occur in vegetative parts during growth which **DONOT** go on to form gametes can be classified as:
   (a) Auxotrophic mutations
   (b) Somatic mutations
   (c) Morphological mutations
   (d) Oncogenes

121. Arabidopsis is advantageous for plant genetic research because:
   (a) It is commercially important as a food crop.
   (b) It is having longer life cycle.
   (c) It is a small plant with a small genome size which can be raised inexpensively.
   (d) It is a close relative of corn and results with this species can be applied to problems in corn.

122. DNA polymerase processivity:
   (a) Is a measure of the number of nucleotides joined before the polymerase dissociates.
   (b) Is determined by the ability of the enzyme to also have nuclease activity.
   (c) Is a measure of thermal stability of the enzyme.
   (d) Is a measure of rate of elongation of newly synthesized strands.

123. Dye injected into a plant cell might be able to enter an adjacent cell through a:
   (a) Tight junction.
   (b) Microtubule.
   (c) Desmosome.
   (d) Plasmodesma

124. The most dominant trait incorporated in transgenic plants worldwide is:
   (a) Insect resistance
   (b) yield
   (c) Nutritional quality
   (d) Herbicide tolerance

125. Clean gene technology in developing transgenic plants means:
   (a) Transgenic plants without marker genes.
   (b) Transgenic plants with provision of removing marker gene after transformation.
   (c) Plant obtained with conventional breeding approach.
   (d) Transgenic plants obtained through plastid transformation.

126. Transformation method which avoids use of plant tissue culture technique is:
   (a) Electroporation
   (b) Biolistic
   (c) In planta
   (d) Microinjection

127. Which of the following is an example of GURT?
   (a) Hybridoma technology
   (b) PCR technology
   (c) Terminator technology
   (d) Transgenic technology

128. Tobacco leaf discs are transferred with Agrobacterium tumefaciens strain containing binary vector (GUS as reporter gene) with selectable marker neo (kanamycin resistant gene) and then regenerated to the plants. The plants are kanamycin resistant but leaf tissues are negative to GUS assay. The explanation is:
   (a) The plants are transformed for both the genes but GUS gene is turned off.
   (b) The plants are transformed to only neo genes not the GUS genes.
   (c) The plants are not transformed at all, but the development of kanamycin resistance is due to somaclonal variation.
   (d) all of the above.

129. Some of the genes from viruses introduced into plants in fully functional form often exhibit Mendelian inheritance, because:

(a) The genes are stably integrated in chromosomes.
(b) The genes are stably maintained in vectors.
(c) The genes are co- expressed with chromosomal genes.
(d) The genes are not interrupted by introns.

130. Which of the following techniques can be utilized to measure the rate of diffusion of membrane proteins?
(a) Patching and capping
(b) Immunodiffusion
(c) Patch-clamp
(d) FRAP

131. A researcher made an interesting observation about a protein made by the rough ER and eventually used to build a cell's plasma membrane. The protein in the membrane was slightly different from the protein made in the ER. The protein was probably changed in the:
(a) Golgi apparatus.
(b) Smooth ER.
(c) Mitochondrion.
(d) Nucleus

132. A particular enzyme loses its activity if just stored in normal saline. However, if normal saline contains 10 mM 2-mercaptoethanol, a reducing agent the enzyme retains its activity. What can you conclude about the enzyme from above?
(a) It has methionine residues that are necessary for activity.
(b) It has sulfhydryl groups that are necessary for activity.
(c) It has disulphide bonds that are necessary for activity.
(d) It has histidine residues that are necessary for activity.

133. The major contribution to the stability of Watson-Crick structure of DNA in aqueous solution comes from:
(a) Hydrogen bonds between Watson –Crick base pairs.
(b) Stacking interaction of bases.
(c) Counter-ion condensation on phosphates.
(d) Entropic contribution.

134. Optimum bead loading for cell disruption in a bead mill is:
(a) 40-50%
(b) 75-85%
(c) 60-70%
(d) 55-65%

135. Driving force for a membrane process is only the concentration difference in the case of:
(a) Reverse osmosis
(b) Ultrafiltration
(c) Microfiltration
(d) Dialysis

136. The basic equation characterizing filtration is governed by:
(a) Darcy's law
(b) Fourier law
(c) Fick's law
(d) Stokes law

137. Sedimentation constant (S) is the ratio of:
(a) Rate of sedimentation to acceleration due to gravity.
(b) Rate of sedimentation to angular acceleration.
(c) Rate of sedimentation to relative acceleration.
(d) Velocity of sedimentation to acceleration due to gravity.

138. The oxygen solubility in a bioreactor depends upon:
(a) Agitation
(b) Aeration
(c) Both Agitation and Aeration

(d) Viscosity and surface tension

139. In which type of elution technique, there is no change in gradient with respect to time?
(a) Isocratic elution technique
(b) Stepwise elution technique
(c) Linear elution technique
(d) Exponential elution technique

140. For 100% purity of peak recovery in chromatography, the desired resolution factor (Rs) is:
(a) Rs=0.99
(b) Rs= 1
(c) Rs=1.5
(d) Rs= infinity

141. One of the these purification steps requires initial high ionic strength in sample:
(a) Ion exchange chromatography.
(b) Hydrophobic interaction chromatography.
(c) Chromatofocusing.
(d) Preparative chromatography.

142. The bioprocess model that differentiates cells on the basis of morphology and /or size distribution is:
(a) Structured model
(b) Unstructured model
(c) Segregated model
(d) Non-segregated model

143. Unit of second order rate constant is:
(a) mol $L^{-1}$ $S^{-1}$
(b) $sec^{-1}$
(c) $mol^{-1}$ L $S^{-1}$
(d) $mol^{-2}$ L2 $S^{-1}$

144. The E. coli concentration in a growth medium is 0.6 g/l. The respiration rate of E. coli at this condition in 0.6 g/l. h. What will be the oxygen uptake rate?
(a) 36 g/g.h
(b) 36 g/l.h
(c) 0.1 g/g.h
(d) 0.01 g/l h

145. In equilibrium condition of the Freundlich adsorption isotherm:
(a) The solid loading increases with the increase of equilibrium concentration.
(b) The solid loading decreases with the increase of equilibrium concentration.
(c) The solid loading takes place independent of the increase of equilibrium concentration.
(d) The solid loading initially decreases and then increases.

146. In an enzyme catalyzed reaction, Km = $4\times10^{-5}$ µmol/l, and the rate of reaction (V) at substrate concentration [S] = $1.2\times10^{-2}$ M is 80 µmol/l-min. Assume no inhibitor is present. Vmax is practically equal to:
(a) 40 µmol/l-min
(b) 80 µmol/l-min
(c) 120 µmol/l-min
(d) $4.8 \times 10^{2}$ µmol/l-min

147. Immobilization of microbial cells:
(a) Increases apparent Ks.
(b) Decreases apparent Ks.
(c) Has no effect on Ks.
(d) Increases cell's affinity for the substrate.

148. In the Dynamic gassinol method, the volumetric oxygen transfer coefficient (KLa) is given by:
(a) X- intercept

(b) Y- intercept
(c) Slope
(d) Inverse of Y- intercept

149. The ratio of BOD/COD is approximately 0.5. When this ratio falls below 0.3, it signifies that it:
(a) Contains large amount of microorganism.
(b) Contains large amount of organic compounds.
(c) Contains large amount of organic compounds that are not easily biodegradable.
(d) Contains no organic compounds.

150. For running a Continuous Stirred Tank Reactor, critical dilution rate is:
(a) Equal to the washout rate.
(b) Less than the washout rate.
(c) Higher than the washout rate.
(d) Unpredictable

151. In continuous sterilization process, fluid flows through the holding section where there is:
(a) A positive axial dispersion value.
(b) A negative axial dispersion value.
(c) Axial dispersion is zero.
(d) No relationship between axial dispersion and fluid flow.

152. The physical significance of specific growth rate constant is:
(a) Rate at which the organism is growing.
(b) Fraction per unit growth of microorganism per unit time.
(c) Grams of cell formed per grams cell mass per unit time.
(d) Gram of cells formed per unit time.

153. Supercritical fluid (SCF) extraction is much better than normal solvent extraction. This is because:
(a) SCF is non –toxic.
(b) Diffusivity is much higher than normal solvent.
(c) Handling of SCF is much easier.
(d) SCF viscosity is higher than normal solvent and hence extraction is better.

154. Growth yield coefficient is defined as:
(a) Cell mass formed: substrate utilized.
(b) Substrate utilized: cell mass formed.
(c) Product formed: cell mass formed.
(d) Carbon dioxide produced to substrate utilized.

155. Anticancer vitamin is:
(a) Retinol
(b) Phylloquinone
(c) Thiamine
(d) Pyridoxine

156. If the rate of product formation is approximately proportional to the rate of cell growth, then this pattern of product formation is referred to as:
(a) Non-growth associated
(b) Growth associated
(c) Uncoupled
(d) Metabolically uncoupled

157. The viscosity of a fluid decreases with increasing stirrer speed. This fluid would be best described as being:
(a) Newtonian
(b) Pseudoplastic
(c) Dilatant
(d) Thixotropic

158. The addition of acid to maintain the pH at 2 –2.6 in the filtered fermentation broth before penicillin extraction is carried out to extract maximum amount of penicillin in solvent phase. The pH is adjusted to 2 – 2.6 because this helps:
(a) In precipitation of proteins.
(b) In maintaining penicillin in aqueous phase.
(c) In maintaining penicillin in organic phase.
(d) In reducing the bacterial contamination.

159. The advantage of counter current flow in the heat exchanger is always desirable as in counter current system:
(a) Temperature control is easier.
(b) Area required for heat transfer is less.
(c) Fluid flow is easy.
(d) Terminal temperature difference is less.

160. Which of the following is the name of the satellite developed recently to scan the oceans around the country?
(a) INSAT-2D
(b) INSAT-1B
(c) INSAT-2E
(d) Aryabhatta

161. Which one of the following algae is a wonder crop with about 70% protein even surpassing famous Soya bean in food value?
(a) Chlorella
(b) Dunaliella
(c) Scenodesmus
(d) Spirulina

162. The origin of Tetradotoxin in mollusks is:
(a) Endogeneous
(b) Exogeneous
(c) Symbiotic microorganisms
(d) All the above

163. Which of the following commercially available cancer drug is obtained from marine source?
(a) Bleomycin
(b) AraC
(c) Cisplatin
(d) Vinblastin

164. Spores of Gracilaria settle on hard substrate, begin to germinate by cell division within:
(a) 12hrs
(b) 20hrs
(c) 48hrs
(d) 24hrs

165. The waves which generally occur during hurricanes are called:
(a) Seismic sea waves
(b) Storm waves
(c) Tsunami
(d) Both (A) and (B)

166. Heparin is a:
(a) Lipopolysaccharide.
(b) Glycated lipopolysaccharide.
(c) Sulphated polysaccharide.
(d) Sulphated lipopolysaccharide.

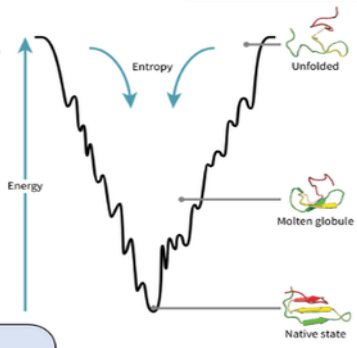
167. Eutrophication in coastal water results in the following phenomenon:
(a) Red tide

# VEDEMY'S CAPSULE ( VEDEMY'S SPECIAL NOTES)

## Amino acid Classes

| | |
|---|---|
| *Essential* | **M**y **V**ery **T**alented **F**riend **I**s **W**aiting **F**or **K**ajo**L** |
| *Semi-essential* | **R**ahu**L** |
| *Non-Polar* | **GAV** के लोग **PILW** लेकर **FM** सुन रहे थे |
| *Polar Uncharged* | **CN**(कार्टून नेटवर्क) pe **STY**(सत्य) **Q**ues पूछते है |
| *Negative charged* | Ye **DE**kh |
| *Positive charged* | **RaHuL** bola |
| *Gluco-ketogenic* | **I**tni **T**alented **WYF** (wife) |
| *Ketogenic* | **K**ajo**L** |

## Protein Folding Curve




**Energy profile-**
**High**
- **U**- Unstructured
- **M**- molten globule
- **D**- discrete structure
- **N**- native
- **A**- amorphous
- **A**- amyloid

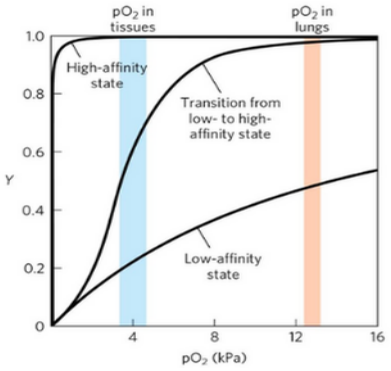
**Low**

**Urmila Matoldkar ka DNA Achha hai**

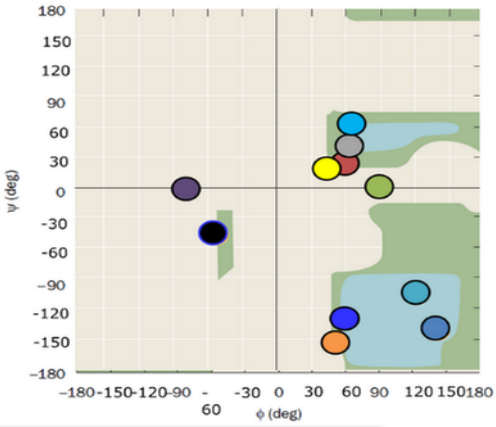
## Hemoglobin

**State of Hb – MOLD**
- **O**xy Hb
- **L**ess acidic (Tensed state)
- **D**eoxy Hb
- **M**ore acidic (Relaxed state)

**Affinity of Curve – DRIL**
- H+, Temp. BPG, $CO_2$
- **I**ncrease
- **L**eft shift
- **D**ecrease
- **R**ight shift

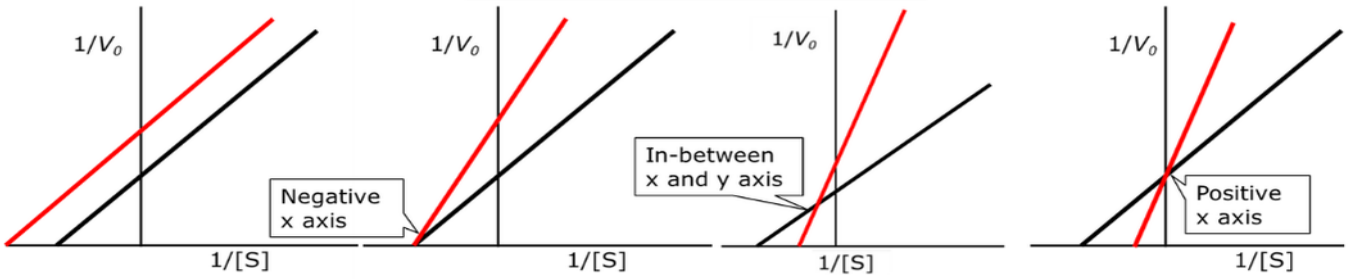



## Ramachandran plot




| Secondary Structure | Phi | Psi |
|---|---|---|
| AP β Sheet | +140⁰ | -135⁰ |
| P β Sheet | +120⁰ | -115⁰ |
| CTH | +50⁰ | -150⁰ |
| L-α-H | -60⁰ | -50⁰ |
| R-α-H | +60⁰ | +50⁰ |
| Type-I i+1 | +60⁰ | +30⁰ |
| Type-I i+2 | +90⁰ | 0⁰ |
| Type-II i+1 | +60⁰ | -120⁰ |
| Type-II i+2 | -80⁰ | 0⁰ |

## Enzyme Inhibition Curve




**Uncompetitive Inhibition**
Decrease $K_m$ = increased $1/K_m$
Decreased $V_{max}$= increased $1/V_{max}$

**Noncompetitive Inhibition**
Decreased $V_{max}$= increased $1/V_{max}$

**Mixed Inhibition**
$K_m$ increase
$V_{max}$ decrease

**Competitive Inhibition**
Increase $K_m$ = decreased $1/K_m$

**UP** ke **NaNa** patekar **MI** ka **PC** lekar aaye
- **U**ncompetitive
- **P**arallel
- **N**on-competitive
- **N**egative x axis
- **M**ixed
- **I**n-between x and y axis
- **P**ositive x axis
- **C**ompetitive

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(b) Diurnal tide
(c) Mixed tide
(d) Neap tide

168. Barophiles are capable of growth up to:
(a) 100 to 200 atm
(b) 700 to 800 atm
(c) 500 to 600 atm
(d) 1 to 100 atm

169. The most abundant group of organisms inhabiting hydrothermal vents are:
(a) Sulphate reducing bacteria
(b) Chemoautotrophic sulphur bacteria
(c) Sulphur oxidizing chemolithotrophs
(d) Nitrifiers

170. Deep sea hydrothermal vents are habitats where the primary producers are:
(a) Organotrophic bacteria
(b) Chemolithotrophic bacteria
(c) Chemoorganotrophs
(d) Methylotrophs

171. Giant tube worms receive their nutrition:
(a) Through unusual haemoglobins which bind $H_2S$ as well as $O_2$, transport to the trophosome and release to bacterial symbionts.
(b) From methanotrophic symbionts living in symbiotic association.
(c) From thermophilic prokaryotes which reside in smoker chimneys.
(d) Through normal haemoglobin.

172. The lux gene from Vibrio fischeri has been used to make glowing tobacco plants. This gene is involved in:
(a) Bioluminescence
(b) Photosynthesis
(c) Phosphorescence
(d) Fluorescence

173. Hydrocolloids extracted from seaweeds have attained commercial significance specially as:
(a) Detergents
(b) Biofuels
(c) Food additives
(d) Laboratory chemicals

174. . _____ is used in the production of explosives.
(a) Carrageenan
(b) Alginate
(c) agar
(d) xanthine

175. Nutraceuticals available in the market from marine sources are largely from
(a) Bacteria
(b) Fungi
(c) Diatoms
(d) Macro algae

176. _____ are being cultured and harvested as a source of biofuels:
(a) Anaerobic bacteria
(b) Luminescent bacteria
(c) Non-methanogenic bacteria
(d) Sea weeds

177. The repeating galactose units of all carrageenans is joined by:
(a) α 1-3 glycosidic linkages

(b) β 1-4 glycosidic linkages
(c) Both (A) and (B)
(d) None

178. Fish can survive inside a frozen lake because:
(a) Fish hibernate in ice.
(b) Fish are warm blooded animals.
(c) Ice is a good conducto of heat.
(d) Water near the bottom does not freeze.

179. The virus-host surface interaction is a:
(a) Specific event
(b) Non-specific event
(c) Random attachment
(d) Natural event

180. Which one of the following tests is **NOT** suitable for immunocytochemical studies of pathogens?
(a) Immunofluorescence
(b) Immunoperoxidase
(c) Immunoelectrophoresis
(d) Immunoelectron microscopy

181. The insertion of foreign DNA into nonessential region of vaccinia virus can be achieved by:
(a) Homologous recombination
(b) Heterologous recombination
(c) Conjugation
(d) Hybridization

182. Antiviral cellular immunity is predominantly mediated by:
(a) CD 8+ cytotoxic T lymphocytes
(b) Natural killer cells
(c) CD4+ T lymphocytes
(d) Dendritic cells

183. Activation of classical pathway of complement requires:
(a) Antigen-antibody reaction
(b) Properdin
(c) Interleukin
(d) Interferon

184. Bovine group A rotavirus contains:
(a) ss RNA
(b) ds RNA
(c) ss DNA
(d) ds DNA

185. Use of 2-deoxy adenosine in semen sample may:
(a) Decrease sperm motility.
(b) Increase sperm motility.
(c) Inactivate sperms.
(d) Separate head of sperm from the tail.

186. In cows, before embryo transfer, they are grown up to:
(a) Mid morula stage
(b) Late morula stage
(c) Very early morula stage
(d) Blostocyst stage

187. Capacitation of sperm takes place in the reproductive tract of cows due to presence of :
(a) Amino acids
(b) Proteins

(c) Galactosamine
(d) Glycosaminoglycan

188. Sperm DNA is covered by:
(a) Lipid
(b) Protamines
(c) Carbohydrate
(d) Histones

189. One of the following is **NOT** a viral disease of sheep:
(a) FMD
(b) PPR
(c) Bluetongue
(d) Haemonchosis

190. Nili Ravi is a breed of:
(a) Cattle
(b) Sheep
(c) Goat
(d) Buffalo

191. Average gestation period of cow is:
(a) 280 days
(b) 245 days
(c) 310 days
(d) 325 days

192. Cow comes in heat every:
(a) 19 to 20 days
(b) 30 to 45 days
(c) 40 to 50 days
(d) 10 to 15 days

193. One of the following diseases has been eradicated from India:
(a) Sheep pox
(b) PPR
(c) Rinderpest
(d) BQ

194. BSE is caused by:
(a) Prion
(b) Viroid
(c) RNA virus
(d) Mycoplasma

195. Fertilized single cell cattle egg is what type of stem cell?
(a) Totipotent stem cell
(b) Pluripotent stem cell
(c) Multipotent stem cell
(d) None of the above

196. β-lactoglobulin promoter is used for expression of gene in:
(a) Liver
(b) Spleen
(c) Mammary gland
(d) Lymphnode

197. Which one of the following virus vectors has been used for development of bluetongue virus particle like recombinant vaccine?
(a) AcNPV
(b) BmNPV
(c) HSV

(d) VSV

198. Which one of the following is connected with 'Ranikhet disease'?
(a) Poultry
(b) Cows
(c) Fishes
(d) Sheep

199. For searching a query sequence with a database, which of the following statement is CORRECT?
(a) Nucleotide query against a nucleotide sequence database is done by blastp.
(b) Protein query against a translated nucleotide sequence database is done by blastp.
(c) Translated nucleotide query against a protein database is done by blastx.
(d) Protein query against a protein database is done by tblastn.

200. Which is the default scoring matrix used in BLAST?
(a) PAM62
(b) BLOSUM 62
(c) BLOSUM 60
(d) BLOSUM 80

201. PAM matrices are derived by noting evolutionary changes in protein sequences that are more than:
(a) 80% similar
(b) 60% similar
(c) 40% similar
(d) 25% similar

202. Which alignment is used to predict whether two sequences are homologous or **NOT**?
(a) Local
(b) Global
(c) Pair-wise
(d) Multiple

203. In Molecular Dynamics simulation, the dependence is on:
(a) Only position.
(b) Only momentum.
(c) Both position and momentum.
(d) Either position or momentum.

204. In phylogenetic analysis, maximum likelihood method is chosen when the sequences have:
(a) Strong similarity.
(b) Local similarity.
(c) Medium level similarity.
(d) No clear identifiable similarity.

205. The method of maximum parsimony is also known as:
(a) Maximum evolution method.
(b) Minimum evolution method.
(c) Zero evolution method.
(d) Moderate evolution method.

206. In Needleman Wunsch algorithm of pairwise alignment of sequences with lengths n and m, the computational time is proportional to:
(a) n x m
(b) (n+1) x (m+1)
(c) n + m
(d) n x (m+1)

207. In a PHYLIP output, the first line is two numbers, what do they indicate?
(a) Number of sequences, length of alignment.
(b) Length of alignment, number of sequences.
(c) Number of gaps, number of sequences.

(d) Number of sequences, number of gaps.

208. BLAT is used to find:
(a) Regions of higher identity within genomic assemblies.
(b) Regions of higher differences within genomic assemblies.
(c) Folds in a RNA sequence.
(d) Secondary structures in a given protein.

209. Homology modeling may be distinguished from ab initio prediction because:
(a) Homology modeling requires a model to be built.
(b) Homology modeling requires alignment of a target to a template.
(c) Homology modeling is usefully applied to any protein sequence.
(d) The accuracy of homology modeling is independent of the percent identity between the target and the template.

210. Molecular Dynamics simulation is carried out for:
(a) Obtaining ensemble of structures at physiological condition.
(b) Obtaining the structure at global energy minimum.
(c) Fitting prospective drug candidate molecules to a receptor.
(d) Modeling a protein structure from sequence alone.

211. A left-handed alpha helix falls in the Ramachandran plot under:
(a) Allowed region.
(b) Partially allowed region.
(c) Disallowed region.
(d) Line joining allowed and partially allowed region.

212. The Greek key motif is composed of:
(a) Four alpha helices.
(b) Three alpha helices and one beta strand.
(c) Two alpha helices and two beta strands.
(d) Four beta strands.

213. Which of the following statements is TRUE regarding a secondary amide?
(a) It can only participate in hydrogen bonding as a hydrogen bond donor.
(b) It can only participate in hydrogen bonding as a hydrogen bond acceptor.
(c) It can participate in hydrogen bonding both as a hydrogen bond donor and a hydrogen bond acceptor.
(d) It cannot participate in hydrogen bonding at all.

214. If systematic conformational search is performed for a molecule with six rotatable bonds and step size is 30 degree then number of conformers will be:
(a) 1, 895, 672
(b) 2, 985, 984
(c) 2, 008, 672
(d) 1, 895, 760

215. Which of the following amino acids are more likely to occur in alpha helices?
(a) A,E,L,M
(b) P,G,Y,S
(c) A,G,Y,W
(d) A,C,G,S

216. The alpha helix can be called a 3.613 helix. The numbers refer to:
(a) The number of residues and the pitch of the helix.
(b) The number of residues and number of atoms in the helix.
(c) The number of residues in a turn of the helix and the number of atoms in the hydrogen bond ring.
(d) The number of turns and diameter of the helix.

217. Arrange the following in hierarchical top to bottom order as is done in SCOP:
(a) Classes, domains, superfamilies, folds, families.
(b) domains, superfamilies, folds, families, classes.

(c) superfamilies, folds, families, domains, classes.
(d) Classes, folds, superfamilies, families, domains.

218. Which of the following cases are commonly used?
(a) Gap opening penalty = -2, gap extension penalty = -0.5
(b) Gap opening penalty = -0.5, gap extension penalty = -2.0.
(c) Gap opening penalty = -100, gap extension penalty = 0
(d) Gap opening penalty = -100, gap extension penalty = -100

219. The description of a new organism identified must be submitted to a Journal and the name validated before it is formally accepted as a new taxon of prokaryotes. The Journal is:
(a) Bergey's Manual.
(b) International Journal of Systematic and Evolutionary Microbiology.
(c) The Prokaryotes.
(d) Applied and Environment Microbiology.

220. The Omph protein is a type of porin, synthesized in bacterial cells grown under a pressure of:
(a) One atmosphere
(b) 100 to 200 atm
(c) 500 to 600 atm
(d) 600 to 700 atm

221. Gasohol in USA is produced by adding 10% ethanol to lead-free gasoline. The combustion of gasohol produces:
(a) Lower amounts of CO and nitrogen oxides than pure gasoline.
(b) Lower amounts of $CO_2$ and higher amounts of $SO_2$ than pure gasoline.
(c) Lower amounts of $CO_2$ and CO than pure gasoline.
(d) Higher amounts of $CO_2$ and CO than pure gasoline.

222. Some extremophiles produce extremozymes which have major industrial application as:
(a) Many industrial processes operate best at high temperatures.
(b) They have high specificity and their ability to distinguish between chiral isomers enable them to function in extremes environment.
(c) They are always produced by hyperthermophiles.
(d) Many bioprocesses operate at low pH.

223. The main pacemaker for endogenous rhythms (Circadian rhythms) is the:
(a) Zeitgeber
(b) Suprachasmatic nucleus
(c) Optic chiasm
(d) Core body temperature

224. Epulopiscium fishelsoni whose length ranges from 200-500 μm belongs to the microbial group:
(a) Microalgae
(b) Fungi
(c) Protozoa
(d) Bacteria

225. Agar-agar is a polymer of:
(a) Glucose
(b) Sulphated sugar
(c) Pectin
(d) Protein

226. The most uncommon characteristic of marine microorganisms is:
(a) They require low nutrients.
(b) They are slow growing.
(c) 95% are gram negative.
(d) They do not exhibit pleomorphism.

227. Which of the following statements is **FALSE** when describing SWISS-PROT?

(a) It is a curated protein sequence database.
(b) Data is redundant.
(c) Provides a high level of annotations.
(d) It is maintained by Swiss Institute of Bioinformatics and EBI.

228. Threading approaches can be used to:
(a) Predict secondary structures of proteins.
(b) Build phylogenetic trees.
(c) Identify distantly related structural homologs of proteins.
(d) To check the fitness of a modeled protein structure.

229. Linkage analysis is performed in a large family with an autosomal hemolytic anemia, using a polymorphic marker within the β- globin locus. The LOD score at b=0 is negative infinity. The LOD score at b=0.01 is -4.5. You conclude that the disorder in this family:
(a) Is due to a point mutation in the β- globin gene.
(b) Is due to a mutation in a gene on chromosome 11, 10cM centromeric β- globin.
(c) Is not due to a β-globin gene mutation.
(d) Is an acquired disorder due to a somatic gene mutation.

230. A catalyst is one which speeds up the reaction by:
(a) The enthalpy of the reaction.
(b) Decreasing the free energy of the reaction.
(c) Increasing the kinetic energy of the reaction.
(d) Decreasing the activation energy of the reaction.

231. Transfer of T-DNA from Ti-plasmid into plant cells is mediated by:
(a) MOB-gene
(b) Nif gene
(c) Vir gene
(d) Octopine gene

232. During RNA polymerase II transcription initiation, phosphorylation of the following factor is essential to commence transcription:
(a) Polymerase II CTD
(b) TFIID
(c) TFIIH
(d) TFIIE

233. In human genome, approximately--------of the DNA codes for proteins:
(a) 10%
(b) 2%
(c) 50%
(d) 20%

234. A linear fragment of DNA will be unstable if it carries:
(a) Two origins of replication..
(b) Two centromeres.
(c) Two telomeres.
(d) Two selection markers.

235. A restriction endonuclease recognizes a 8 bp unbiased conserved sequence as its cleavage site. How many probable site(s) can be present in a 70 kb DNA fragment?
(a) 2
(b) 1
(c) 4
(d) 6

236. Typical nucleosomal organization of gene is **NOT** found in the nuclei of:
(a) Human liver cells
(b) Muscle cell
(c) Human sperm

(d) Neural cells

237. Which of the following organelles is surrounded by a single membrane?
(a) Chloroplast
(b) Mitochondria
(c) Peroxisomes
(d) Nucleus

238. If a DNA sequence predominantly contains alternating pyrimidines and purines, which of the following DNA structures is highly favored?
(a) A-DNA
(b) B-DNA
(c) Z-DNA
(d) A-B-DNA

239. In a temperature-sensitive mutant bacteria, at non-permissive temperature, there are huge accumulation of Okazaki fragments. The bacteria are mutant for:
(a) DNA polymerase
(b) DNA topoisomerase I
(c) DNA ligase
(d) DNA gyrase

240. Which among the following enzymes is **NOT** a component of nitrogen assimilation complex?
(a) Nitrate reductase
(b) Glutamate synthase
(c) Lactate dehydrogenase
(d) Glutamine synthetase

241. A cDNA encoding an eukaryotic gene was ligated to an expression vector which was then introduced into E. coli for expression of protein. However, the experiment resulted in poor expression of inactive form of the protein, which could be due to:
(a) Absence of capping at the 5'end of the transcript.
(b) Absence of polyadenylation at the 3'end of the transcript.
(c) Codon bias.
(d) Lack of splicing machinery in E. coli.

242. The genomic DNA fraction which has highest value of cot ½ on Cot curve represents:
(a) Highly repetitive DNA
(b) Moderately repetitive DNA
(c) Minisatellite DNA
(d) Unique DNA

243. The best method to permeabilize yeast cells chemically is to use:
(a) EDTA and Lysozyme
(b) β-(1,3) glucanase and protease
(c) α-(1,6) glucanase
(d) Alkaline hydroxylase

244. Asparaginase is used as an:
(a) Anti-tumor agent.
(b) Anti-tuberculosis agent.
(c) Anti-malarial agent.
(d) Anti-diabetic agent.

245. Which of the following will have the largest interfacial area per unit volume?
(a) A bubble with a diameter of 1 mm.
(b) A bubble with a diameter of 2 mm.
(c) A bubble with a diameter of 3 mm.
(d) A bubble with a diameter of 4 mm.

246. Mr. B and Mrs. B have a 2-month-old baby with Down's syndrome. Her Karyotype is showing translocation variety of Down's syndrome. Which of the following investigations will you advise to the parents before next pregnancy?
   (a) Triple test
   (b) ?-foetoprotein analysis
   (c) Karyotyping
   (d) ?-hCG analysis

247. Occurrence of TB in HIV patients suggests the potent protective role played by:
   (a) NK cells in healthy individuals.
   (b) NKT cells in healthy individuals.
   (c) CD3+ T cells in healthy individuals.
   (d) CD4+ T cells in healthy individuals.

248. Which of the following types of neurons is primarily lost in Parkinson's disease?
   (a) Dopaminergic neurons in the substantia nigra.
   (b) Cholinergic neurons in the brain stem.
   (c) Noradrenergic neurons in the cerebellum.
   (d) GABA-ergic neurons in cortex.

249. The term k in the following energy expression E = ½ k (theta-thetao)2 represents:
   (a) Van der Waals interaction.
   (b) Stretching constant for bond angle variation.
   (c) Torsonal potential.
   (d) Kinetic energy of an atom.

250. "Heyflick's limit refers to which one of the following phenomena?
   (a) DNA repair
   (b) Cell senescence in vitro
   (c) Protein synthesis
   (d) RNA transport

# DBT-BET-JRF 2008 ANSWER KEY

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | b | d | d | b | b | c | c | a | b | b | b | a | c | a | b | a | d | c | a |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| c | b | b | b | c | a | a | b | b | c | b | c | c | c | a | a | c | a | c | b |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| a | a | c | c | a | c | d | a | c | d | d | a | a | b | a | c | d | d | c | d |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| a | d | c | c | d | a | b | b | a | c | c | c | b | d | a | b | c | c | b | a |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| c | c | b | a | d | d | a | a | d | d | a | c | b | d | c | c | c | b | c | a |
| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| a | d | a | d | d | b | b | d | d | d | a | a | a | b | a | d | c | c | b | b |
| 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 |
| c | a | d | d | b | c | c | d | a | d | a | b | b | b | d | a | b | c | a | c |
| 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 |
| b | c | c | d | a | b | a | c | c | b | c | c | b | a | a | b | b | c | b | c |
| 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 |
| d | d | b | d | d | d | a | c | c | b | a | a | c | b | d | d | c | d | a | c |
| 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 |
| a | a | a | b | b | d | d | b | d | d | a | a | c | a | a | c | a | a | c | b |
| 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 |
| a | b | c | d | b | b | a | a | b | a | b | d | c | b | a | c | d | a | d | c |
| 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 |
| a | b | b | d | b | d | b | c | c | d | c | a | b | b | b | c | c | c | c | b |
| 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | | | | | | | | | | |
| c | d | b | a | a | c | d | a | b | b | | | | | | | | | | |