

**VPM CLASSES**

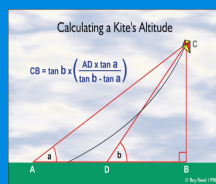
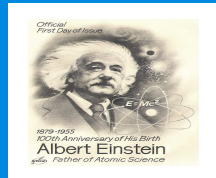
**IIT JAM - BIOLOGICAL SCIENCE**  
**MOCK TEST PAPER**

**M.Sc ENTRANCE**

**FULL LENGTH MOCK TEST PAPER**

- DETAILED SOLUTIONS
- PROJECTED IIT JAM RANK





## IIT-JAM - BIOLOGICAL SCIENCE MOCK TEST PAPER

- **Attempt ALL the objective questions (Questions 1-100). Each of these questions carries three marks. 1 negative mark for each wrong answer.**
- **Pattern of questions : MCQs**
- **Total marks : 300**
- **Duration of test : 3 Hours**

# VPM CLASSES

For IIT-JAM, JNU, GATE, NET, NIMCET and Other Entrance Exams

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1. At the center of all 20 standard amino acids is what is termed the  $\alpha$ -carbon that is covalently bonded with four other chemical groups. Which of these four chemical groups is not a normal component of all amino acids?  
(A) An amino group  
(B) A carboxyl group  
(C) A methyl group  
(D) (C) a side chain (R group)
2. Which process does not generate  $\text{CO}_2$ ?  
(A) The citric acid cycle  
(B) The conversion of pyruvate to lactic acid  
(C) The conversion of pyruvate to acetyl-CoA  
(D) The conversion of pyruvate to ethanol
3. The word, used for the small solid supports onto which are spotted hundreds of thousands of tiny drops of DNA that can be used to screen gene expression, is  
(A) Southern blot  
(B) Cloning library  
(C) DNA microarrays  
(D) Northern blot
4. Protozoans called choano flagellates live in small clusters. They look very much like choanocytes, special feeding cells found in sponges, which are simple animals. Why might biologists find choano flagellates of great evolutionary interest?  
(A) They show how the very first organisms might have lived.  
(B) They might show how the first heterotrophs lived.  
(C) Offer hint about origin of multicellular organism

- (D) They suggest what the first eukaryotes might have been like.
5. In a \_\_\_\_\_ habitat natality exceeds mortality and in a \_\_\_\_\_ habitat mortality exceeds natality.
- (A) Fragmented. . .hot spot  
(B) Tropical. . .polar  
(C) In both tropical and polar environments there may be regions where with differing rates of mortality and natality.  
(D) Natural . . .source
6. The water readily available to plants for absorption by roots is
- (A) Gravitational water  
(B) Capillary water  
(C) Rain water  
(D) Hygroscopic water
7. The zoned reserve concept of landscape management calls for:
- (A) Many small, interconnected nature preserves.  
(B) Protected areas to be surrounded by transitional areas.  
(C) Bioremediation.  
(D) Assisting the movement of individuals from a source to a sink population.
8. To enter or leave a cell, substances must pass through
- (A) A microtubule.  
(B) The Golgi apparatus.  
(C) The nucleus.  
(D) The plasma membrane.
9. L-alanine and D-alanine
- (A) Are present in virtually all proteins.  
(B) Lack an R group.

- (C) Are enantiomers.  
(D) Are super imposable isomers of each other.
10. The enzyme that converts 3-phosphoglycerate to 2-phosphoglycerate is a  
(A) Transferase.  
(B) kinase.  
(C) mutase.  
(D) phosphorylase
11. Which of the following DNA sequences is not found in a typical *E. coli* expression vector?  
(A) A transcription termination sequence  
(B) A ribosome-binding site  
(C) A promoter  
(D) A telomere
12. Which of the follow does not apply to a population with a low effective population size?  
(A) Genetic drift.  
(B) Increased genetic diversity.  
(C) Reduced heterozygosity.  
(D) Increased homozygosity.
13. The relative location of four genes on a chromosome can be mapped from the following data on crossover frequencies
- | Gene Pair | Frequency of Crossover |
|-----------|------------------------|
| B and D   | 5%                     |
| C and A   | 15%                    |
| A and B   | 30%                    |
| C and B   | 45%                    |
| C and D   | 50%                    |

Which of the following represents the relative positions of these four genes on the chromosome?

- (A) ABCD
- (B) ADCB
- (C) CABD
- (D) CBAD

14. Species that have a disproportionately large impact on the maintenance of an ecosystems biodiversity are referred to as :

- (A) Exotics
- (B) Primary producer
- (C) Archaea
- (D) Keystone species

15. A polypeptide is cleaved into peptides by treatment with trypsin and cyanogen bromide, and the peptides are purified and sequenced. The sequences of the peptides (from N to C-terminus) are shown below. (Note: Trypsin cleaves after K and R residues; cyanogen bromide cleaves after M.)

Trypsin peptides

T-1 GASMALIK  
T-2 EGAAYHDFEPIDPR  
T-3 DCVHSD  
T-4 YLIACGPMTK

Cyanogen bromide peptides

C-1 EGAAYHDFEPIDPRGASM  
C-2 TKDCVHSD  
C-3 ALIKYLIACGPM

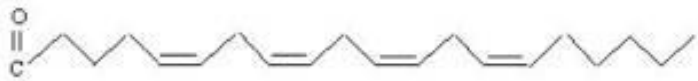
- (A) A.T-3
- (B) B.C-1
- (C) D.T-4
- (D) C.C-2

16. A songbird that hears the songs of other species as well as its own.

- (A) Will sing the song of its own species, but needs practice.  
(B) Will instinctively sing the song of its species perfectly.  
(C) Will sing other songs as well as its own.  
(D) Will be confused and not master any song.
17. The function of water in photosynthesis is to  
(A) Combine with  $\text{CO}_2$   
(B) Absorb light energy  
(C) Supply electrons in the light-dependent reactions  
(D) Transport  $\text{H}^+$  ions in the light-independent (dark) reactions
18. An example of associative learning would be:  
(A) Classical conditioning  
(B) Operant conditioning  
(C) Pavlovian conditioning  
(D) All of the above
19. Because proteins can absorb light maximally at 280 nm, they can be identified and quantified in solution by using a spectrophotometer. Which of the following is true about the absorption of light by proteins?  
(A) Proteins absorb infrared light.  
(B) All amino acids absorb light equally.  
(C) The greater the concentration of protein in a solution, the more 280 nm transmitted light will be detected by a spectrophotometer.  
(D) Absorbance of 280 nm light by proteins increases with the concentration of the protein.
20. Which technique is not normally associated with DNA fingerprinting?  
(A) Restriction endonuclease digestion  
(B) The polymerase chain reaction (PCR)

- (C) DNA microarray analysis  
(D) Southern blotting
21. High value of BOD (Biochemical Oxygen Demand) shows  
(A) Water is normal  
(B) Water is highly polluted  
(C) Water is less polluted  
(D) None of these
22. An exception to cell theory?  
(A) Plant cell  
(B) Virus  
(C) Fungi  
(D) Animal cell
23. Which of the following amino acids has a net negative charge at pH 7.0?  
(A) Glycine  
(B) Threonine  
(C) Aspartate  
(D) Arginine
24. The isoelectric point, or pI, of an amino acid or a protein is  
(A) The pH at which the amino acid or protein has no net charge.  
(B) Zero at pH 7.0.  
(C) The pH at which the amino acid or protein is neither hydrophobic nor hydrophilic.  
(D) The measure of how hydrophobic an amino acid or protein is.
25. Peptide bonds, which covalently link two amino acids, result from  
(A) The oxidation of amino acids.  
(B) The condensation of amino acids.



- (C) The hydrolysis of amino acids.  
(D) Hydrogen bonds between amino acids.
26. DNA synthesis takes place in which of following phase of the cell cycle?  
(A) G<sub>0</sub>  
(B) G<sub>1</sub>  
(C) S phase  
(D) G<sub>2</sub> phase
27. What is the nomenclature for the fatty acid shown below?
- 
- (A) 20:8(D<sup>5,6,8,9,11,12,14,15</sup>)  
(B) 20:8(D<sup>6,7,9,10,12,13,15,16</sup>)  
(C) 20:4(D<sup>5,8,11,14</sup>)  
(D) 20:4(D<sup>6,9,12,15</sup>)
28. By what mechanism would a nonpolar molecule move across a membrane if it is moving down its concentration gradient?  
(A) Facilitated diffusion  
(B) Passive transport  
(C) Simple diffusion  
(D) Active transport
29. Presence of AIDS virus cannot be detected by-  
(A) ELISA  
(B) Western blotting  
(C) Northern Blot  
(D) Assay of full-length ds DNA

30. Human hemoglobin has four polypeptide subunits: two identical 16,000 molecular weight  $\alpha$ -chains and two identical 16,000 molecular weight  $\beta$ -chains, whereas the RNA polymerase of influenza virus has three unique polypeptide subunits: PA, PB1 and PB2. Which of the following statements is true?
- (A) Influenza virus RNA polymerase consists of protomers.  
(B) Human hemoglobin and influenza virus RNA polymerase are oligomeric proteins.  
(C) Human hemoglobin and influenza virus RNA polymerase are multisubunit proteins.  
(D) Human hemoglobin consists of oligopeptide subunits.
31. The acrosome of the sperm is formed from the
- (A) Mitochondria  
(B) Centrosome  
(C) lysosome  
(D) golgi bodies
32. The level of protein structure that describes all aspects of the three-dimensional folding of a polypeptide is referred to as the
- (A) Quaternary structure.  
(B) Secondary structure.  
(C) Primary structure.  
(D) Tertiary structure.
33. X-ray diffraction and nuclear magnetic resonance (NMR), two techniques used to solve the three-dimensional structure of molecules, differ in that
- (A) NMR is limited to molecules that can be crystallized.  
(B) NMR is better for analyzing large proteins.  
(C) Only molecules to be analyzed by NMR need to be labeled with isotopes.

- (D) Only x-ray diffraction is successful on all proteins.
34. Which of the following experiments provided the first evidence that the amino acid sequence of a polypeptide chain contains all the information required to fold the chain into its native, three-dimensional structure?
- (A) When ribonuclease is treated with urea, it loses its catalytic activity.
- (B) When denatured ribonuclease is allowed to renature, it regains its catalytic activity.
- (C) When renatured ribonuclease is allowed to denature, it regains its catalytic activity.
- (D) Addition of mercaptoethanol causes ribonuclease to regain catalytic activity.
35. Two or more proteins that have little sequence similarity, but share the same major structural motif and have functional similarities, belong to the same
- (A) Fold.
- (B) Family.
- (C) super family.
- (D) Motif.
36. Below are the standard reduction potentials ( $E'^{\circ}$ ) for two conjugate redox pair:
- Pyruvate/lactate-  $E'^{\circ} = -0.185$
- NAD<sup>+</sup>/NADH  $E'^{\circ} = -0.320$
- Which of the following is true?
- (A) The pyruvate/lactate conjugate redox pair has a greater tendency to lose electrons than the NAD<sup>+</sup>/NADH redox pair.
- (B) Pyruvate has a greater affinity for electrons than NAD<sup>+</sup>.
- (C) NAD<sup>+</sup> is a reducing agent.

(D) Under standard conditions,  $\text{NAD}^+$  is more likely to be converted to NADH, than pyruvate is to be converted to lactate.

37. The Hsp70 molecular chaperone proteins are more abundant in cells stressed by elevated temperatures because
- (A) Hsp70 is needed to unfold proteins denatured by heat.
  - (B) Hsp70 is needed to destroy proteins denatured by heat.
  - (C) Hsp70 is needed to stimulate the aggregation of proteins denatured by heat.
  - (D) Hsp70 is needed to protect proteins that have been denatured by heat.
38. Steroid hormones
- (A) Bind cell surface receptors.
  - (B) Are insoluble in blood.
  - (C) Have a very rapid effect (within seconds) on target cells.
  - (D) Mediate their effects through second messengers.
39. Hydrogen bonds between amino acids in a polypeptide occur between which chemical groups?
- (A) The C=O and C-H groups
  - (B) The C=O and C-R groups
  - (C) The C=O groups
  - (D) The C=O and N-H groups
40. Proline residues are most likely to occur in which of the following secondary structures?
- (A) An  $\alpha$  helix
  - (B) A  $\beta$  turn
  - (C) A  $\beta$  sheet
  - (D) A coiled

41. Which of the following is true about sickle-cell anemia?
- (A) People with sickle-cell anemia have inherited one or more alleles for sickle-cell hemoglobin.
  - (B) People with sickle-cell anemia have normal levels of hemoglobin and normal numbers of erythrocytes.
  - (C) People with sickle-cell anemia have sickle-cell hemoglobin molecules that form insoluble fibers.
  - (D) People with sickle-cell anemia have a mutation in either the  $\alpha$  or  $\beta$  hemoglobin chains.
42. Which of the following is true about the structure of all immunoglobulins?
- (A) The chains are linked by disulphide bonds.
  - (B) They consist of two heavy chains and two light chains.
  - (C) The five classes of immunoglobulins each have their own characteristic type of light chain.
  - (D) An antigen-binding site is formed by the combination of two heavy chains.
43. Complete  $\beta$ -oxidation of a 16-carbon saturated fatty acid
- (A) Generates eight molecules of NADH.
  - (B) Requires eight  $\beta$ -oxidation cycles.
  - (C) Generates eight molecules of  $\text{FADH}_2$ .
  - (D) Generates eight molecules of acetyl-CoA
44. During skeletal muscle contraction, which of the following narrows?
- (A) The I band
  - (B) The Z disk
  - (C) The A band

(D) The Mline

45. Which of the following is true about the difference between oxidative phosphorylation and photophosphorylation?
- (A) Photophosphorylation occurs only in photosynthetic organisms and oxidative phosphorylation occurs only in non-photosynthetic organisms.
- (B) In oxidative phosphorylation, NADH donates electrons; in photophosphorylation NADPH donates electrons.
- (C) Photophosphorylation occurs only in light; oxidative phosphorylation occurs only in darkness.
- (D) In oxidative phosphorylation,  $O_2$  is reduced to  $H_2O$ ; in photophosphorylation,  $H_2O$  is oxidized to  $O_2$ .
46. The number of ATP required for urea synthesis is :
- A) 0
- (B) 1
- (C) 2
- (D) 3
47. Why are concerns about the individuality of clones scientifically questionable?
- (A) Identical twins have very different personalities, and they are essentially clones of each other
- (B) Clones of plants are made all the time when gardeners grow new plants from cuttings
- (C) The environment and not the genes is the major shaper of the personality
- (D) No clone would ever want to be exactly the same as his parent
48. Which of the following is true about the role of ATP during skeletal muscle contraction?

- (A) After hydrolysis of ATP at the myosin head, Pi and ADP are immediately released.
- (B) The release of Pi from myosin is needed for the "power stroke" that causes filament sliding.
- (C) Binding of ATP causes the myosin head to bind actin filaments.
- (D) The hydrolysis of ATP at the myosin head causes myosin to tightly bind the next actin subunit
49. Which of the following is true of cyclin-dependent kinases (CDKs)?
- (A) They are inactivated by binding to cyclin.
- (B) Their activity changes throughout the cell cycle.
- (C) They are degraded as a result of addition of ubiquitin.
- (D) They alter the activity of cyclins.
50. Which of the following binding constants represents the highest affinity?
- (A)  $K_a = 1.0 \times 10^7 M^{-1}$
- (B)  $K_d = 1.0 \times 10^{-9} M$
- (C)  $K_d = 1.5 \times 10^{-9} M$
- (D)  $K_a = 2.0 \times 10^8 M^{-1}$
51. How does hemoglobin bind O<sub>2</sub> cooperatively?
- (A) The binding of one molecule of O<sub>2</sub> to one subunit of hemoglobin enhances the assembly of other subunits to form a complete hemoglobin protein.
- (B) The binding of one molecule of O<sub>2</sub> to one hemoglobin protein enhances the binding of a molecule of O<sub>2</sub> to a different hemoglobin protein.

- (C) The binding of one molecule of  $O_2$  to one subunit of hemoglobin enhances the affinity of the same subunit for more molecules of  $O_2$ .
- (D) The binding of one molecule of  $O_2$  to one subunit of hemoglobin enhances the affinity of other subunits for  $O_2$ .
52. What is the role of cytotoxic T cells (TC) in the immune response?
- (A) They produce cytokines and interleukins that stimulate the proliferation of immune cells.
- (B) They produce immunoglobulins (antibodies) that bind bacteria or viruses and target them for destruction.
- (C) They destroy virally infected cells to which they are complexed through their T-cell receptors.
- (D) They ingest large particles and cells by phagocytosis.
53. What is the biological advantage to the sigmoidal binding curve of hemoglobin for oxygen?
- (A) It ensures that hemoglobin has a high affinity for oxygen.
- (B) It allows hemoglobin to bind oxygen irreversibly.
- (C) It ensures that hemoglobin can bind oxygen only weakly.
- (D) It allows hemoglobin to shift between low and high affinities for oxygen.
54. Which of the following is true about the T (tense)  $\rightarrow$  R (relaxed) transition of hemoglobin?
- (A) The T state of hemoglobin binds oxygen with a higher affinity than the R state.
- (B) The binding of  $O_2$  to a subunit in the T state can cause the transition of other subunits to the R state.
- (C) The T state has a narrower pocket between &#946; subunits than does the R state.



- (D) When hemoglobin undergoes the T  $\rightarrow$  R transition, the structures of the individual subunits change dramatically.
55. Higher alcohol present in waxes is :
- (A) Benzyl  
(B) Methyl  
(C) Ethyl  
(D) Cetyl
56. Which of the following is not a function of hemoglobin?
- (A) It delivers O<sub>2</sub> to peripheral tissues.  
(B) It removes CO<sub>2</sub> from peripheral tissues.  
(C) It delivers CO<sub>2</sub> to the lungs.  
(D) It delivers H<sup>+</sup> to peripheral tissues.
57. The Bohr effect, the effect of pH and CO<sub>2</sub> concentration on the binding and release of oxygen by hemoglobin, dictates that
- (A) Oxygen binds hemoglobin better at low pH.  
(B) Oxygen and H<sup>+</sup> are bound at the same sites in hemoglobin.  
(C) The binding of CO<sub>2</sub> is inversely related to the binding of oxygen.  
(D) The binding of CO<sub>2</sub> is inversely related to the binding of H<sup>+</sup>.
58. Unsaturated fatty acid found in the cod liver oil and containing 5 double bonds is:
- (A) Clupanodonic acid  
(B) Cervonic acid  
(C) Elaidic acid  
(D) Timnodonic acid
59. Differentiate the following equation using the standard rules:  $y = x^0$

(A)  $\frac{dy}{dx} = x^8$

(B)  $\frac{dy}{dx} = 9x^8$

(C)  $\frac{dy}{dx} = \frac{x^{10}}{10}$

(D)  $\frac{dy}{dx} = 8x^9$

60. A simple plot of  $V_0$  versus  $[S]$  is superior to a double-reciprocal plot ( $1/V_0$  versus  $1/[S]$ ) if you are trying to
- (A) Determine  $V_{\max}$ .
  - (B) Detect allosteric regulation.
  - (C) Determine the type of inhibition.
  - (D) Determine the  $K_m$ .
61. In competitive inhibition, increasing concentrations of the inhibitor will have the following effect on the kinetics of the enzyme:
- (A)  $K_m$  will decrease.
  - (B)  $V_{\max}$  will stay the same.
  - (C) The reaction will cease because the inhibitor binds irreversibly.
  - (D)  $K_m / V_{\max}$  will stay the same.
62. Which of the following is a structural polysaccharide in plant cells?
- (A) glycogen
  - (B) amylose
  - (C) starch

(D) cellulose

63. If  $y = x^6$ , then  $\int y \, dx =$

(A)  $\int y \, dx = \frac{x^7}{7} + c$

(B)  $\int y \, dx = \frac{x^7}{6} + c$

(C)  $\int y \, dx = \frac{x^5}{6} + c$

(D)  $\int y \, dx = \frac{x^5}{5} + c$

64. Which is the safest and most effective way to develop a vaccine that would protect the recipient if exposed to the natural toxin of *Vibrio cholerae*, the bacterium that causes cholera.

(A) Use purified natural toxin as a vaccine to elicit an immune response.

(B) Use live toxin-bearing *Vibrio cholerae* as a vaccine to elicit an immune response.

(C) Use a genetically engineered version of the cholera toxin with an altered carbohydrate-binding site.

(D) Use a genetically engineered version of the cholera toxin lacking the carbohydrate-binding site as a vaccine to elicit an immune response.

65. Treatment of gram-positive bacteria with penicillin will have what effect?

(A) It will inhibit cell wall synthesis by hydrolyzing the ( $\alpha 1 \rightarrow 4$ ) bonds that connect the carbohydrate residues of the cell wall peptidoglycan.

- (B) It will inhibit synthesis of lipopolysaccharides in the outer membrane.
- (C) It will inhibit cell wall synthesis by preventing the synthesis of peptide cross-links in the cell wall peptidoglycan.
- (D) It will have no effect on gram-positive bacteria; it is specific to gram-negative bacteria.
66. Which of the following is true about reducing ends?
- (A) All polysaccharides have an equal number of reducing ends as nonreducing ends.
- (B) Polysaccharides grow in the direction of the nonreducing end.
- (C) Disaccharides are named starting with the reducing end.
- (D) All disaccharides have one reducing end.
67. What role do lectins play in the infection of host cells by influenza virus?
- (A) A plasma membrane lectin on the host cell binds the carbohydrate moiety on an influenza virus glycoprotein.
- (B) Lectins present inside the cell target influenza viruses for transfer to the lysosome.
- (C) An influenza virus lectin binds to the carbohydrate moiety on glycoproteins on the host cell surface.
- (D) An influenza virus lectin binds to the carbohydrate moiety on glycolipids on the host cell surface.
68. Which of the following is true about the difference between nucleotides and nucleosides?
- (A) Nucleotides lack a nitrogenous base.
- (B) Nucleosides lack a ribose sugar.
- (C) Nucleotides lack a phosphate.
- (D) Nucleosides lack a phosphate.

69. The chemical synthesis of DNA
- (A) Occurs in a 5' to 3' direction.
  - (B) Is carried out with the growing strand attached to a solid support.
  - (C) Can add one or more nucleotides per chemical cycle.
  - (D) Requires a DNA template.
70. If a chemical reaction starts with 1M concentrations each of reactants A and B and products C and D, under what conditions of  $K'$  eq and  $\Delta G^\circ$  will the reaction proceed in the forward direction ( $\Delta G^\circ = -RT \ln K'$  eq)?
- (A) If  $K'$  eq is greater than 1 and  $\Delta G^\circ$  is negative.
  - (B) If  $K'$  eq is 0 and  $\Delta G^\circ$  is negative.
  - (C) If  $K'$  eq is negative and  $\Delta G^\circ$  is negative.
  - (D) If  $K'$  eq is less than 1 and  $\Delta G^\circ$  is positive.
71. Deoxyribonucleic acid (DNA) is different from ribonucleic acid (RNA) in that
- (A) DNA contains a 3' H, whereas RNA contains a 3' OH.
  - (B) Only DNA utilizes the base uracil.
  - (C) Only RNA can be hydrolyzed by alkaline conditions.
  - (D) Only DNA contains a pentose sugar.
72. "Chargaff's rules" about the composition of bases in DNA dictates that
- (A) The sum of purine residues must equal the sum of pyrimidine residues.
  - (B) The sum of A-T base pairs must equal the sum of G-C base pairs.
  - (C) The base composition of DNA is the same in all species.
  - (D) DNA specimens isolated from different tissues of the same species vary in base composition
73. DNA can be sequenced by the Sanger method in which

- (A) Radioactively labeled DNA is subjected to four sets of base-specific cleavage reactions.
- (B) Automated sequencing can be done using different fluorescent-labeled 2' deoxynucleotides.
- (C) The required DNA synthesis is performed via automated chemical synthesis.
- (D) The sequence can be read by a laser beam

74. Which of the following is true concerning a DNA double helix found inside cells?

- (A) The backbone is positively charged.
- (B) The bases are exposed through the major groove.
- (C) Guanine forms two hydrogen bonds with cytosine.
- (D) Adenine forms two hydrogen bonds with cytosine.

75. Messenger RNAs (mRNAs)

- (A) Are the molecules that store genetic information.
- (B) Specify the amino acid sequences in polypeptide chains.
- (C) Can code for only one polypeptide.
- (D) Consist solely of protein-coding sequence.

76. Calculate the value of  $\theta$  in degrees given that:

$$\cos^2 \theta + \frac{9}{4} = 3$$

- (A)  $60^\circ$
- (B)  $49.6^\circ$
- (C)  $0.52^\circ$
- (D)  $30^\circ$

77. When dNTPs become depleted in the cell, which of the following enzymes will regenerate dNTPs from dNDPs?

- (A) nucleoside diphosphate kinase
- (B) polyphosphate kinase
- (C) creatine kinase
- (D) adenylate kinase

78. What is  $270^\circ$  in radians ?

- (A)  $\frac{3}{2}\pi$
- (B)  $\frac{5}{4}\pi$
- (C)  $\frac{2}{3}\pi$
- (D)  $\frac{3}{4}\pi$

79. The function of macrophages is to-

- (A) Enzyme Secretion
- (B) Engulf Cell organelles
- (C) Engulf Foreign Material
- (D) Kills Invading Bacteria

80. Extra nuclear genetic material is found-

- (A) Ribosome
- (B) ER
- (C) Chloroplast
- (D) Centriole

81. A C3 mustard plant was grown at 300 ppm of CO<sub>2</sub> in 14 h light and 10 h dark cycles, it was transferred to 1000 ppm CO<sub>2</sub>. This will lead to (other environmental parameters remaining identical)-
- (A) Increased photosynthesis
  - (B) Decreased Photosynthesis
  - (C) Increase in Respiration
  - (D) No Change
82. Loss of water from the stomata of leaves are known as
- (A) Guttation
  - (B) Exudation
  - (C) Transpiration
  - (D) Evaporation
83. During rainy season wooden doors are difficult to open or closure because of
- (A) Plasmolysis
  - (B) Imbibition
  - (C) Osmosis
  - (D) Diffusion
84. Plasmolysis occurs due to
- (A) Absorption
  - (B) Osmosis
  - (C) Endosmosis
  - (D) Exosmosis
85. Active uptake of minerals by roots mainly depends on the
- (A) Availability of oxygen



- (B) Temperature  
(C) Light  
(D) Availability of CO<sub>2</sub>
86. The hormone which signals the closure of stomata is  
(A) Auxins  
(B) Cytokinin  
(C) Gibberelline  
(D) Abscisic acid
87. What is the action spectrum of transpiration?  
(A) Orange and red  
(B) Green and ultraviolet  
(C) Blue and red  
(D) None of these
88. Transpiration is least in  
(A) High atmospheric humidity  
(B) good soil moisture  
(C) high wind velocity  
(D) dry environment
89. Water absorption takes place through  
(A) Lateral roots  
(B) Root cap  
(C) Root hairs  
(D) Tap root
90. Which aspect of mitosis is affected by colchicine in inducing polyploidy?  
(A) DNA duplication

- (B) Spindle formation  
(C) Cell plate formation  
(D) Chromosome doubling
91. A cell divides every one minute. At this rate of division it can fill a 100 ml of beaker in one hour. How much time does it take to fill a 50 ml beaker?  
(A) 30 minutes  
(B) 60 minutes  
(C) 59 minutes  
(D) one minute
92. Number of mitotic divisions required to produce 128 cells from a single cell is  
(A) 7  
(B) 8  
(C) 16  
(D) 32
93. To initiate translation of m-RNA in eukaryotes, all of the following factors are required except:  
(A) adenosine and guanosine triphosphates  
(B) eukaryotic initiation factors  
(C) formyl methionine-t-RNA  
(D) m-RNA with the triplet AUG near the 5' end
94. Biogas is  
(A) Methane rich fuel  
(B) eco friendly and pollution free source  
(C) Propane rich fuel  
(D) Both A and C
95. Enzyme immobilization is

- (A) Conversion of an active enzyme into inactive form  
(B) Providing enzyme with protective covering  
(C) Changing a soluble enzyme into insoluble state  
(D) Changing pH so that enzyme is not able to carry out its function
96. Humuline is  
(A) Carbohydrate  
(B) Protein  
(C) Fat  
(D) Antibiotics
97. Which category of hypersensitivity BEST describes hemolytic disease of the newborn caused by Rh incompatibility?  
(A) atopic or anaphylactic  
(B) cytotoxic  
(C) immune complex  
(D) delayed
98. Which one of the following statements concerning immunoglobulin allotypes is CORRECT?  
(A) Allotypes are found only on heavy chains.  
(B) Allotypes are determined by class I MHC genes.  
(C) Allotypes are confined to the variable regions.  
(D) Allotypes are due to genetic polymorphism within a species.
99. The class of immunoglobulin present in highest concentration in the blood of a human newborn is  
(A) IgG.  
(B) IgM.  
(C) IgA.

(D) IgD.

100. AIDS is caused by a human retrovirus that kills

- (A) B lymphocytes.
- (B) lymphocyte stem cells.
- (C) CD4-positive T lymphocytes.
- (D) CD8-positive T lymphocytes

## ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Answer	D	B	C	C	D	B	A	D	C	C	D	B	C	D	B	B	D	D	D	C
Question	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Answer	C	B	C	A	B	C	C	C	D	C	D	D	C	B	C	B	D	B	D	B
Question	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	C	A	D	A	D	D	A	B	C	B	D	C	D	B	D	D	D	A	B	B
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Answer	B	D	A	D	C	B	C	D	B	A	C	A	D	B	B	D	A	A	C	C
Question	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Answer	A	C	B	D	A	D	C	A	C	B	C	A	A	D	B	B	D	D	A	C

1.(D) Not all amino acids have a methyl group bonded to the  $\alpha$ -carbon. Only alanine has a methyl group that is its side chain. In addition to having a side chain group, all amino acids have a carboxyl group, an amino group, and a hydrogen atom covalently bonded to the  $\alpha$ -carbon.

2.(B) Under anaerobic conditions, pyruvate (a 3-carbon molecule) is converted to lactic acid (a 3-carbon molecule) and no CO<sub>2</sub> is generated.

- 3.(C)** DNA micro arrays is the technique to analyze expression of the thousand genes at same time
- 4.(C)** Choanocytes bear more than a passing resemblance to Choanoflagellates, and demonstrate key steps in the evolution of animals. Scientist Nicole King helped to establish the distinction. DNA sequencing indicates that multicellular choanoflagellates and poriferans are sister groups, both descended from the same eukaryotic clade.
- 5.(D)** There are a number of models describing population structure, many of which have the capacity to incorporate spatial habitat effects. One such model is the source-sink model, that describes a system where some habitats have a natality that is higher than mortality (source) and others have a mortality that exceeds natality (sink)
- 6.(B)** Capillary water held in spaces is readily available for root hairs for absorption
- 7.(A)** Zoned reserves are important to preserve habitats from human development. This basically means that they stop people from harming natural environments by preventing them from building in those habitats.
- 8.(D)** The cell membrane or plasma membrane is a biological membrane that separates the interior of all cells from the outside environment. The cell membrane is selectively permeable to ions and organic molecules and controls the movement of substances in and out of cells.
- 9.(C)** The L- and D-stereoisomer forms of amino acids are enantiomers, which means that they are nonsuperimposable mirror images of each other. Alanine, like all amino acids beside glycine, has an  $\alpha$ -carbon atom to which four different groups are attached and therefore has a chiral center. Molecules with chiral centers have stereoisomers (e. g., L-alanine and D-alanine) that are enantiomers-isomers that are nonsuperimposable mirror images of each other

- 10.(C) Mutases are a subclass of isomerases that catalyze the transfer of a functional group from one position to another in the same molecule. Phosphoglycerate mutase catalyzes the transfer of a phosphoryl group from 3-phosphoglycerate to generate 2-phosphoglycerate
- 11.(D) Telomeres, which are needed to maintain yeast artificial chromosomes (YACs), are not found in a typical *E. coli* expression vector. A typical *E. coli* expression vector contains a promoter, a ribosome-binding site, and a transcription termination sequence.
- 12.(B) Genetic diversity is studied and is applicable to large population size.
- 13.(C) Based on distance between the genes constructed,
- |     |     |     |
|-----|-----|-----|
| 15% | 30% | 5%  |
| C   | A   | B D |
|     | 50% |     |
- 14.(D) A keystone species is a species that has a disproportionately large effect on its environment relative to its abundance. Such species play a critical role in maintaining the structure of an ecological community, affecting many other organisms in an ecosystem and helping to determine the types and numbers of various other species in the community.
- 15.(B) C-1 or T-2 could be N-terminal peptides because they overlap at their N-terminal ends.
- 16.(B) Birds exposed to songs of a different species do not start imitating that song. Instead they seem to know to only imitate songs coming from specific. They have the ability to discriminate between songs of their own species and those of other species.

- 17.(D)** Photolysis of water in light reaction results in formation of protons and electrons that are directed in formation of ATP and NADPH. That are used in fixation of  $\text{CO}_2$  in dark reactions
- 18.(D)** Associative learning is the process by which an association between two stimuli or a behavior and a stimulus is learned. The two forms of associative learning are classical and operant conditioning.
- 19.(D)** The absorbance of light by the sample is directly proportional to the concentration of the protein
- 20.(C)** DNA microarrays, used only to look at RNA expression patterns, are not used in DNA fingerprinting. DNA fingerprinting normally uses PCR, restriction endonuclease digestion and southern blotting to detect genetic differences between individuals
- 21.(C)** BOD represents that high demand for oxygen and water inside is less polluted
- 22.(B)** Virus is not having mass of protoplasm containing nucleus surrounded by plasma membrane, it is not living. But, it has genetic material that could reproduce it. Hence it an exception to cell theory.
- 23.(C)** Aspartate (aspartic acid) has a negatively charged R group and is thus negatively charged at pH 7.0
- 24.(A)** Amino acids and proteins have a characteristic pH at which the molecule has no net charge. This value is a function of all of the ionizable groups (the carboxyl group, amino group, and certain functional groups) on the amino acids.
- 25.(B)** A peptide bond is formed by removal of the elements of water (dehydration) from the  $\alpha$ -carboxyl group of one amino acid with the  $\alpha$ -amino group of another.
- 26.(C)** DNA replication is not taking place in S-phase of cell cycle.

- 27.(C)** There are 20 carbon atoms in the fatty acid shown above, with 4 double bonds between C-5 and C-6, C-8 and C-9, C-11 and C-12, and C-14 and C-15 (C-1 being the carboxyl carbon). Therefore, the correct nomenclature for this fatty acid is 20:4(D<sup>5,8,11,14</sup>).
- 28.(C)** Membranes are impermeable to most polar or charged solutes, but permeable to nonpolar compounds. Therefore, as long as the nonpolar molecule moving across a membrane is moving down its concentration gradient, it will do so by simple diffusion.
- 29.(D)** Presence of AIDS virus detected by both the ELISA and western or northern blot but not assay of full-length ds DNA
- 30.(C)** Both proteins are multisubunit proteins because they consist of two or more polypeptides. The individual polypeptide chains in a multisubunit protein may be identical or different.
- 31.(D)** Acrosome of the sperm help in penetration of the egg during fertilization, It is a cap-like structure derived from the Golgi apparatus
- 32.(D)** All aspects of the three-dimensional folding of a polypeptide is described by tertiary structure
- 33.(C)** Only certain isotopes, such as <sup>1</sup>H, <sup>13</sup>C, <sup>15</sup>N, <sup>19</sup>F, and <sup>31</sup>P, possess the kind of nuclear spin needed to produce a detectable NMR signal.
- 34.(B)** The only information that specified the correct folding of the protein back to its native, catalytically active state was its amino acid sequence.
- 35.(C)** Proteins and protein families belong to the same superfamily if they share little sequence similarity, but have the same major structural motif and are functionally



- 36.(B)** The standard reduction potential is a measure of the affinity of the electron acceptor of each redox pair for electrons. The electron acceptor of pyruvate/lactate redox pair (pyruvate) has a greater tendency to gain electrons than the electron acceptor of the  $\text{NAD}^+/\text{NADH}$  redox pair ( $\text{NAD}^+$ ) because the former redox pair has a greater standard reduction potential ( $E^\circ$ ) than the latter redox pair.
- 37.(D)** Hsp70 protects denatured proteins by binding to regions of unfolded polypeptides rich in hydrophobic residues, preventing inappropriate aggregation.
- 38.(B)** Steroid hormones (estrogen, progesterone, and cortisol, for example) are too hydrophobic to dissolve readily in the blood and are carried on specific carrier proteins from their point of release to their target tissues.
- 39.(D)** Hydrogen bonds in a polypeptide form between the oxygen atom of the  $\text{C}=\text{O}$  group of one amino acid and the hydrogen atom of the  $\text{N}-\text{H}$  group of another amino acid.
- 40.(B)** Proline residues often occur in  $\beta$  turns because the peptide bond involving the imino nitrogen of proline assumes a configuration that is amenable to a tight turn.
- 41.(C)** Sickle-cell hemoglobin molecules associate abnormally with each other, forming long, fibrous aggregates. These aggregates cause the distortion of the shape of the erythrocyte.
- 42.(A)** There are disulphide bonds that link the heavy chains to each other and there is a disulphide bond that links a light chain to a heavy chain.
- 43.(D)** Each  $\beta$ -oxidation cycle generates one molecule of  $\text{NADH}$ , one molecule of  $\text{FADH}_2$ , and one molecule of acetyl-CoA, except for the last  $\beta$ -oxidation cycle, which results in two molecules of acetyl CoA. Therefore, a 16-carbon saturated fatty acid will be completely oxidized by seven  $\beta$ -oxidation cycles, generating eight molecules of acetyl-CoA.

- 44.(A)** The I band is formed where thick filaments are absent. During skeletal muscle contraction, the thick and thin filaments slide past each other, resulting in the narrowing of the I band as thick filaments are brought closer together
- 45.(D)** In oxidative phosphorylation,  $O_2$  is reduced to  $H_2O$  at the expense of NADH and  $FADH_2$ , which are oxidized to  $NAD^+$  and  $FADH^+$ . In photophosphorylation,  $H_2O$  is oxidized to  $O_2$ , with  $NADP^+$  accepting electrons from  $H_2O$  to generate NADPH.
- 46.(D)** The overall equation of the urea cycle is:  
$$NH_3 + CO_2 + \text{aspartate} + 3 \text{ATP} + 2 H_2O \rightarrow \text{urea} + \text{fumarate} + 2 \text{ADP} + P_i + \text{AMP} + PP_i$$
- 47.(A)** Clones of plants are made when gardeners grow plants from cuttings, but this fact has no bearing on the individuality of a human clone. The environment and the genes interact in complex ways to produce the personality, so a human mind cannot be entirely dependent on environmental factors any more than it can be entirely dependent on genetic ones. It may be true that clones would dislike being identified with their parent, but they may also relish the association – predicting these feelings is inexact. However, identical twins are indeed human beings with the same genomes, and yet they grow up to be very different people. Clones, raised in even more different environments, would probably differ even more greatly. the correct answer is 1: Identical twins have very different personalities, and they are essentially clones of each other.
- 48.(B)**  $P_i$  release triggers a "power stroke," a conformational change in the myosin head that moves actin and myosin filaments relative to one another
- 49.(C)** Only immunoblots enable an approximation of an antigen's molecular weight because the assay requires the separation of proteins in a sample by an SDS

polyacrylamide gel, which separates proteins by molecular weight. By comparing the mobility of the protein antigen of interest with the mobility of proteins of known molecular weight (molecular weight standards), one can approximate the molecular weight of the antigen. In ELISA assays, proteins in a sample are placed inside the wells of a polystyrene tray and are never separated by size

- 50.(B)**  $K_a$  is an association constant that provides a measure of the affinity of a ligand L for a protein P.  $K_a = [PL]/[P][L]$ . The reciprocal of the  $K_a$  is the dissociation constant  $K_d$ .  $K_d = [P][L]/[PL]$ . Therefore, the answer with the highest  $K_a$  or the lowest  $K_d$  has the highest affinity. The binding constant with the highest affinity is answer B:  $K_d = 1.0 \times 10^{-9}M$ , which expressed as a  $K_a$  would be  $K_a = 1.0 \times 10^9M^{-1}$
- 51.(D)** The binding of one molecule of  $O_2$  to one subunit of hemoglobin mediates the binding of other molecules of  $O_2$  to other subunits of hemoglobin by conformational changes transmitted from one subunit to another by subunit-subunit interactions.
- 52.(C)** Cytotoxic T cells (TC), also known as killer T cells, destroy virally infected cells. TC cells identify virally infected cells by having their surface T-cell receptors bind to viral antigens displayed on the surface of infected cells.
- 53.(D)** A sigmoid shaped binding curve reflects a transition between a low to a high affinity state. Hemoglobin must bind oxygen efficiently in the lungs, where the oxygen pressure is high, and must release oxygen in the tissues, where the oxygen pressure is low.
- 54.(B)** Hemoglobin is an allosteric protein in which the binding of the first  $O_2$  to a subunit in the T state leads to conformation changes of the other subunits to the R state, which has a higher affinity for  $O_2$ .

- 55.(D) A wax is a simple lipid which is an ester of a long-chain alcohol and a fatty acid. The alcohol may contain from 12-32 carbon atoms.
- 56.(D) Hemoglobin does not deliver  $H^+$  to peripheral tissues. Instead, it carries the end products of respiration- $H^+$  and  $CO_2$ -from peripheral tissues to the lungs and kidneys where they are excreted.
- 57.(D) When the concentration of  $CO_2$  and  $H^+$  is high, the affinity of hemoglobin for oxygen is decreased. This aids in the function of hemoglobin as a transporter of both oxygen and cell byproducts. In the peripheral tissues where the concentration of  $CO_2$  and  $H^+$  is high, hemoglobin releases oxygen and takes up  $CO_2$  and  $H^+$ . In the lungs, as  $CO_2$  is excreted and the pH rises, hemoglobin binds more oxygen for transport to the tissues
- 58.(A) The concentrations of the n-3 fatty acids eicosapentaenoic acid (20:5 n-3), docosapentaenoic acid (22:5 n-3) were higher in the cod liver oil. all-cis-7,10,13,16,19-docosapentaenoic acid is an  $\omega$ -3 fatty acid with the trivial name clupanodonic acid, commonly called DPA. It is an intermediary between eicosapentaenoic acid (EPA, 20:5  $\omega$ -3) and docosahexaenoic acid (DHA, 22:6  $\omega$ -3). Seal oil is a rich source.
- 59.(B) If  $y = ax^n$ , then  $\frac{dy}{dx} = a \times n \times x^{n-1}$ , and  $\frac{dy}{dx} = 1 \times 9 \times x^{9-1} = 9x^8$
- 60.(B) Allosteric enzymes display sigmoid kinetic behavior rather than hyperbolic kinetic behavior on simple plots of  $V_o$  versus [S].
- 61.(B) Because the substrate and inhibitor compete for the same active site, a sufficiently high substrate concentration will always displace the inhibitor from the enzyme's active site.

62.(D) Cellulose is a structural polysaccharide in plant cells that give plants tough stalks, stems, trunks, and woody parts

63.(A) If  $y = ax^n$  then  $\int y \, dx = \frac{ax^{n+1}}{n+1} + c$

Therefore,  $\int y \, dx = \frac{x^{6+1}}{6+1} + c = \frac{x^7}{7} + c$

64.(D) This is the safest vaccine. Such a genetically engineered analog of the cholera toxin would not be able to bind to or enter cells (and therefore would be harmless) but might still be able to elicit an immune response. The toxin is a lectin that enters target cells only after interacting with the carbohydrate moiety on a surface glycolipid.

65.(C) Penicillin prevents the synthesis of the cross-links in the cell wall peptidoglycan of gram-positive bacteria. This leaves the cell too weak to resist osmotic lysis.

66.(B) Polysaccharides grow in the direction of the nonreducing end

67.(C) The lectin of the influenza virus, the HA protein, binds a sialic acid-containing oligosaccharide on a cell surface glycoprotein, triggering the entry of the virus into the cell.

68.(D) Nucleosides lack a phosphate group. Nucleosides (a ribose sugar and a nitrogenous base) that contain one or more phosphate groups are called nucleotides.

69.(B) The first nucleotide is attached to a solid support. The growing strand remains attached to this support until the oligonucleotide is complete, at which point the oligonucleotide is cleaved from the solid support and purified.

- 70.(A)**  $K'_{eq} = \frac{[C][D]}{[A][B]}$ . The relationship between  $K'_{eq}$  and  $\Delta G'^{\circ}$  is  $\Delta G'^{\circ} = -RT \ln K'_{eq}$ . The reaction will proceed forward (favor the formation of products C and (D) if  $\Delta G'^{\circ}$  is negative, which can only be achieved if  $K'_{eq}$  is greater than 1.
- 71.(C)** Under alkaline conditions RNA forms 2', 3' cyclic monophosphate derivatives, resulting in hydrolysis of the phosphodiester bonds that link ribonucleotides in an RNA chain
- 72.(A)** The number of adenosine residues equals the number of thymidine residues, and the number of guanosine residues equals the number of cytidine residues. Therefore, if  $A = T$  and  $G = C$ , then  $A + G = T + C$
- 73.(D)** In automated DNA sequencing, the sequencing reactions are electrophoresed through a capillary tube, and the fluorescent-labeled DNA molecules that pass through the capillary are read by a laser beam and recorded by a computer
- 74.(B)** The major groove allows cellular proteins to recognize specific base sequences
- 75.(B)** mRNAs carry the amino acid coding information from DNA so that it can be made into polypeptide chains by the ribosome
- 76.(D)** We can rearrange the equation to give :

$$\cos^2 \theta = \frac{12-9}{4} = \frac{3}{4}$$

$$\cos \theta = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2}$$

Therefore, This is the cosine of 30°. You should memorize the cosine, sine and tangents of common angles such as 0°, 30°, 45°, 60°, 90°, and any related angles.

77.(A) Nucleoside diphosphate kinase catalyzes the transfer of phosphoryl groups from ATP to NDPs or dNTPs to generate NTPs or dNTPs, respectively

78.(A)  $360^\circ = 2\pi$ .

$$\text{Therefore, } 270^\circ = \frac{270}{360} \times 2\pi = \frac{3}{2} \pi \text{ radians.}$$

79.(C) Microphages engulfs foreign material

80.(C) Mitochondria and chloroplast contains nuclear genetic material

81.(A) An increase in  $\text{CO}_2$  in C3 mustard plant from 300ppm to 1000ppm for same cycle keeping other parameters same results in increasing photosynthesis and higher  $\text{CO}_2$  fixation in dark cycles.

82.(C) The process of loss of water from leaves is called as transpiration

83.(B) Wooden doors are swollen during rainy season because it imbbes water.

84.(D) Shrinkage of protoplasm occurs due to loss of water called as exosmosis

85.(A) Oxygen availability determines uptake of minerals

86.(D) ABA helps in closure of stomata.

87.(C) Blue and red light is a key absorption spectrum.

88.(A) High humidity results in lowered transpiration.

89.(C) Root hairs increase area under absorption

90.(B) Colchicines affects spindle fomation during mitosis by inducing polyploidy.

- 91.(C)** It is in 59 minutes as a cell divides in one minute, 60 minutes to fill 100ml beaker. 59 minutes required to fill half the beaker and remaining one minute for the cells to fill half are requiring only one minute filling the full beaker.
- 92.(A)**  $2^n$  for n generations  
 $2^n = 128 ; n=7$
- 93.(A)** Initiation of polypeptide chain in eukaryotes is similar to the in prokaryotes except:  
(A) In eukaryotes formation of methionine does not takes place.  
(B) There are more initiation factor at least 10.  
(C) 40S subunit associates with initiator t-RNA with out the help of m-RNA.
- 94.(D)** Biogas is methane and propane rich fuel.
- 95.(B)** Enzyme immobilization provides protective shielding for an enzyme
- 96.(B)** Humuline is a protein
- 97.(D)** Haemolytic disease of the newborn caused by Rh incompatibility is the best described by delayed hyper sensitivity
- 98.(D)** Allotypes in immunoglobulin are due to polymorphism within a species
- 99.(A)** IgG conc is high in new bom baby blood they are source of natural antibodies from mother.
- 100.(C)** CD4 cell are most affected in AIDS infection