

PART-A

1. In a substitution nucleophilic first order reaction (S_N1) the stereochemical outcome is

- (a) Racemisation
- (b) Inversion of configuration
- (c) Retention of configuration
- (d) Difficult to predict

2. When irradiated with ultraviolet light Chlorine (Cl_2) reacts with tetrachloroethylene. But under similar condition when Oxygen (O_2) is vigorously bubbled through the solution the reaction

- (a) becomes more violent
- (b) does not get affected
- (c) slows down
- (d) stops

3. Which of the following compounds is optically inactive?

- (a) Lactic acid
- (b) 2-Methyl propionic acid
- (c) Tartaric acid
- (d) Butyric acid

4. Addition of excess bromine (Br_2) to 1,4-pentadiene will yield

- (a) Only 4,5 dibromo 1-pentene
- (b) Only 1,2,4,5-tetra bromo pentene
- (c) Mixture of (a) and (b)
- (d) There will be no reaction

5. If you want to synthesize 1-Phenyl ethanol from phenyl magnesium bromide you will have to add

- (a) Water to it
- (b) Formaldehyde to it
- (c) Acetaldehyde to it
- (d) Acetone to it

6. When you will treat phenol with dilute HNO_3 at $20^\circ C$, you will get

- (a) Only ortho nitro phenol
- (b) Only para nitro phenol
- (c) Mixture of ortho and para nitro phenol
- (d) Only 2,4,6 trinitro phenol

7. Soaps are

- (a) Esters of fatty acids
- (b) Metal salts of fatty acids
- (c) Glycerol esters of fatty acids
- (d) Salts of fatty acids with organic bases

8. Natural rubber is a polymer of

- (a) Butadiene
- (b) Isoprene
- (c) Chloroprene
- (d) Neoprene

9. Ethylene when treated with dilute alkaline $KMnO_4$ forms

- (a) Ethyl alcohol.
- (b) Ethylene glycol
- (c) Acetaldehyde
- (d) Ethane

10. EDTA is used as

- (a) Oxidized agent
- (b) Reducing agent
- (c) Chelating agent
- (d) Alkylating agent

11. Linkage present in cellulose molecule is

- (a) β (1 \rightarrow 4)
- (b) α (1 \rightarrow 4)
- (c) α (1 \rightarrow 6)
- (d) both (b) and (c)

12. Blocking action of enzyme through blocking its active site is

- (a) Allosteric inhibition
- (b) Feedback inhibition
- (c) Competitive inhibition
- (d) Non-competitive inhibition

13. Which one of the following is without coenzyme activity?

- (a) Vitamin E
- (b) Thiamine
- (c) Biotin
- (d) Riboflavin

14. Active transport

- (a) Releases energy
- (b) Require energy
- (c) Produces energy
- (d) Produces toxic material

15. Correct sequence of stages in cell cycle is

- (a) G1, S, G2, M
- (b) G1, G2, S, M
- (c) M, S, G1, G2
- (d) G1, G2, M, S

16. 0.1 M acetic acid is mixed with 0.2 M sodium acetate. Give that pK_a of Acetic acid is 4.76, the pH of the mixture will be nearly

- (a) 4.5
- (b) 5.0
- (c) 5.5
- (d) 6.0

17. The scalar product of two vectors (u, u_2, u_3) $(v_1, v_2, v_3) =$

- (a) $u_1v_1 - u_2v_2 - u_3v_3$
- (b) $u_1v_2 - u_2v_1 - u_3v_3$
- (c) $u_3v_1 - u_2v_2 - u_1v_3$
- (d) $u_3v_2 - u_2v_1 - u_1v_3$

18. The determinant of a singular matrix

- (a) is equal to 0
- (b) is greater than 0
- (c) is less than 0
- (d) can be either greater than, equal to or less than 0

19. If the differential equation is stiff

- (a) It should be solved by Gear's method
- (b) Runge-Kutta method
- (c) 2nd order Rung-Kutta method
- (d) Cannot be solved

20. The path of a projectile
 (a) is parabola
 (b) is hyperbola
 (c) is straight line
 (d) depends on the angle of throw

21. The probability of a man hitting a target is $\frac{1}{4}$. The number of times he must fire so that the probability of his hitting the target at least once is greater than $\frac{2}{3}$ is

- (a) 2 (b) 3
 (d) 4 (c) Infinity

22. The number of spectral lines emitted by atomic hydrogen excited to the n^{th} energy level is

- (a) $n(n+1)/2$ (b) $n(n-1)/2$
 (c) $n^2/2$ (d) $n(n-1)$

23. A piece of ice slides down at 45° incline in twice the time if it takes to slide down a frictionless 45° incline. The coefficient of friction between the ice and the incline is

- (a) 2 (b) $\frac{1}{2}$
 (c) $\frac{1}{4}$ (d) $2\frac{1}{2}$

24. A bucket of water is hung from a spring balance. A piece of iron is suspended into the water without touching the sides from an independent support. The reading on the spring balance will

- (a) increase
 (b) decrease
 (c) not change
 (d) decrease with depth of immersion of iron piece

25. Which is not an programming language-

- a. BASIC b. C
 c. MS-WORD d. LOGO

26. Number of values that can be stored in 8 bits are-

- a. 8 b. 16
 c. 64 d. 256

27. If $11X11 = 100$. Then which statement is correct-

- a. Left hand side is binary and right is octal
 b. Left hand side is binary and right is ternary
 c. Left hand side is hexadecimal and right is octal
 d. Left hand side is binary and right is also binary

28. Consider the following truth table.

P	Q	$P < Q$	$P \neq Q$
3	3	0	0
4	5	A	B

The value of A and B will be-

- a. 0,0 b. 0,1
 c. 1,0 d. 1,1

29. A certain planet is revolving in a fixed orbit. If the radius of its orbit is increased four times then its mean surface temperature will decrease-

- a. 1 b. 2
 c. 4 d. 16

30. Charge density is more at poles because-

- a. Magnetic field is parallel to poles
 b. Magnetic field is parallel to equator
 c. Magnetic field is perpendicular to poles
 d. Magnetic field is perpendicular to equator

PART-B

1. Viroids differ from viruses in being

- (a) Naked ANA molecules only
 (b) Naked DNA molecules only
 (c) Naked DNA packaged with viral genomes.
 (d) Satellite ANA packaged with viral genome

2. A virus can be made radioactive by

- (a) culturing the virus in a medium of ^{32}P
 (b) Culturing the virus on a medium of potato, dextrose and ^{32}P
 (c) providing ^{32}P to virus when they are about to attack the bacteria
 (d) providing ^{32}P to a bacterium which have been infected by a virus

3. A short length of double stranded DNA molecule contains 120 adenine and 120 cytosine bases. The total number of nucleotides in this DNA fragment is

- (a) 60 (b) 120
 (c) 240 (d) 480

4. Besides having C, H, O which of these may also contain N, S & P?

- (a) Protein
 (b) Fat
 (c) Carbohydrate
 (d) Vitamins

5. Which of the following element plays an important role in nitrogen fixation?

- (a) Manganese
 (b) Molybdenum
 (c) Zinc
 (d) Copper

6. Specificity of an enzyme depends upon

- (a) Active site
 (b) Linear sequence
 (c) K_m
 (d) Turn over number

7. Sulphur containing Amino acid is

- (a) Valine
 (b) Leucine
 (c) Methionine
 (d) Histidine

8. Viruses are
 (a) Cellular organisms
 (b) Non-cellular organisms
 (c) Unicellular organisms
 (d) Cellular without wall

9. Which of the following does not contain both DNA and RNA ?

- (a) Yeast (b) Bacteria
 (c) Mycoplasma (d) Virus

10. Sodium Dodecyl Sulphate (SDS) is used while separating proteins by polyacrylamide gel electrophoresis because

- (a) It helps in solubilization of proteins thereby making it easier to separate
 (b) It binds to proteins and confers uniform negative charge density thereby making them move during electrophoresis
 (c) Decreases the surface tension of the buffer used for electrophoresis
 (d) Stabilizes the proteins

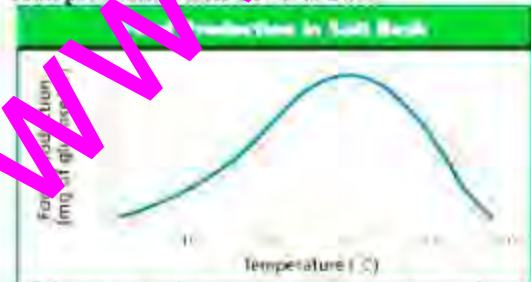
11. Absorption of UV radiation by proteins and nucleic acids is due to transition of Electrons between the

- (a) Vibrational energy levels
 (b) Rotational energy levels
 (c) Nuclear energy levels
 (d) Electronic energy levels

12. Which of these statements is true?

- a. In a pyramid of numbers, the population size usually gets smaller as the trophic level increases.
 b. In a pyramid of biomass, the weight of a lower trophic level is the same as the level above it.
 c. In a pyramid of energy, only about 1% of the energy at one level is available for the next trophic level.
 d. The law of conservation, which can be applied to the pyramid of energy, means that energy is constantly created and destroyed.

13. Which of these statements about the amount of food production after 10° C is true?



- a. Food production stops as temperatures increase beyond 20° C.
 b. Food production continues to increase as temperatures increase beyond 20° C.
 c. Food production drops drastically as temperatures increase beyond 20° C.

d. Food production remains the same as temperatures increase beyond 20° C.

14. Which of these organisms breaks down and releases nutrients from other dead organisms?

- a. producers b. decomposers
 c. herbivores d. carnivores

15. Which of these is NOT an example of a terrestrial ecosystem?

- a. volcano site b. garden plot
 c. rotting log d. human skin

16. What is the difference between mutualism and parasitism?

- a. Mutualism means that one member of a species thrives at the expense of the member of the species. Parasitism means that one member of a species thrives at the expense of the member of the species.
 b. Mutualism means that one member of a species benefits without harming or benefiting the member of another species. Parasitism means that both species' members benefit from the relationship.
 c. Mutualism means that both members of a species benefit from having together. Parasitism means that one member of a species benefits without harming or benefiting the member of another species.
 d. Mutualism means both members of a species benefit from having together. Parasitism means that one member of a species thrives at the expense of the member of the species.

17. Based on the data in the graph, which of the following statements is true?



- a. There is no food production happens at 10° C.
 b. Food production is the smallest at about 20° C.
 c. Food production is the greatest at about 30° C.
 d. Food production at 40° C is about 5 mg of glucose per hour.

18. Which of these organisms uses light energy to manufacture food for itself?

- a. a heterotroph b. an autotroph
 c. a carnivore d. an omnivore

19. Which of the following statements about the biosphere is true?

- a. Ecologists never study animal in Earth's biosphere.
 b. The physical environment of Earth's biosphere is the only factor in influencing living things.
 c. Living things in Earth's biosphere are affected by nonliving things.

d. Earth's biosphere includes the portion of Earth within 1 mile of the surface.

20. A relationship among organisms where one species benefits while the other species neither benefits nor is harmed is called _____

- a. mutualism
- b. predation
- c. parasitism
- d. commensalism

21. A DNA solution of $100\mu\text{M}$ concentration when placed in a cuvette of path length 1 cm gave an absorbency of 0.66. The extinction coefficient of DNA is-

- a. 6.6×10^3
- b. 0.66×10^3
- c. 1.5×10^4
- d. 6.6×10^3

22. Trace of a matrix is

- (a) some of the elements in the main diagonal
- (b) some of the elements in all the diagonals
- (c) value of determinant
- (d) None of the above

23. Formation of alpha helix in proteins is promoted by

- (a) Glutamic acid, arginine and leucine
- (b) Valine, leucine and phenylalanine
- (c) Proline, glycine and aspartic acid
- (d) Asparagine and serine

24. The major source of stability of the DNA Double helix structure is

- (a) Hydrogen bonding between bases
- (b) Screening of phosphate charges by counter ions
- (c) Stacking interaction of neighboring bases
- (d) Solvation of phosphates

25. Urea acts as a protein denaturant because it binds to the

- (a) Charged residues of proteins
- (b) Hydrophobic residues of proteins
- (c) Peptide groups of proteins
- (d) CH_2 group of the protein backbone

26. In Nuclear Magnetic Resonance Spectroscopy the resonance phenomenon is observed after subjecting the nucleus under Question by one of the following electromagnetic radiations.

- (a) Infrared
- (b) X-rays
- (c) Radio frequency
- (d) Microwaves

27. Thermodynamics dictate that entropy, a measure of disorder in a system increase with every spontaneous process. Living system is highly ordered as well as spontaneous. This means that

- (a) Thermodynamics does not apply to living systems
- (b) Living systems increase the entropy of the surroundings
- (c) Living systems decrease the entropy of their surroundings
- (d) Living systems are not really ordered systems

28. Highly cooperative binding of a ligand to multiple binding sites on a macromolecule is best demonstrated by

- (a) Adair equation
- (b) Hill Plot
- (c) Lineweaver-Burk Plot
- (d) Arrhenius Plot

29. A hybridoma cell secreting mouse monoclonal antibodies can be generated by

- (a) fusing spleen cells from immune mice with a B cell from that mice
- (b) culturing B cells in the presence of B cell growth factors
- (c) by transforming splenic B cells from an immune mouse with Epstein Barr virus
- (d) by fusing spleen cells from an immune mice with an appropriate plasma cell line

30. A virus is growing inside a B cell. The Viral antigens

- (a) cannot be presented to T cells under that condition
- (b) will be presented to T cells in association with MHC molecule
- (c) can be presented to T cells in association with both MHC-I and MHC-II molecules
- (d) the virus has to use that B cell before any antigen presentation can take place

31. Super antigens stimulate

- (a) only T cells by binding to TCR in the absence of antigen presenting cells
- (b) can stimulate T, B and any other type of cells
- (c) only T cells by binding to the $\text{V}\beta$ domain of T cells receptor and the MHC-II molecule an antigen presenting cells
- (d) only T cells by binding to CD_2 molecules

32. For developing a candidate vaccine for malaria

- (a) We should identify several T cell and B cell epitopes which can elicit protective response in a large population
- (b) We should identify only few T cell epitopes of the parasite
- (c) We should identify only few B cell epitopes of the parasite
- (d) We should identify epitopes which can induce antibody response in the host

33. In a chemical reaction, transition-state species have free energies

- (a) lower than either the reactants or the products
- (b) higher than either the reactants or the product
- (c) lower than the reactants, but higher than the products
- (d) higher than the reactants, but lower than the products

34. More free energy is released during the citric acid cycle than during glycolysis, but only 1 mole

of ATP is produced for each mole of acetyl CoA that enters the cycle. What happens to most of the remaining free energy that is produced during the citric acid cycle?

- (a) It is used to synthesize GTP
- (b) It is used to reduce electron carriers
- (c) It is lost as heat
- (d) It is used to reduce pyruvate

35. The general name for an enzyme that transfers phosphate groups from ATP to a protein is

- (a) Protein kinase
- (b) Phosphorylase
- (c) Phosphatase
- (d) ATPase

36. How do the daughter cells at the end of mitosis and cytokinesis compare with their parent cell when it was in G₁ of the cell cycle?

- (a) The daughter cells have half the amount of cytoplasm and half the amount of DNA
- (b) The daughter cells have the same number of chromosomes and the same amount of DNA
- (c) The daughter cells have the same number of chromosomes and half the amount of DNA
- (d) The daughter cells have half the number of chromosomes and half the amount of DNA

37. Which of the following is FALSE in comparing prophase I of meiosis and prophase of mitosis?

- (a) The nuclear envelope disassembles in both
- (b) The chromosomes condense in both
- (c) Each chromosome has two chromatids in both
- (d) Tetrads form in both

38. Once transcribed the eukaryotic primary transcript typically undergoes substantial alteration that includes

- (a) Fusion into circular forms known as plasmids
- (b) Linkage to histone molecules
- (c) Union with ribosomes
- (d) Tetrads form in both

39. All of the following are essential control mechanisms for regulation of gene expression in eukaryotic organisms EXCEPT

- (a) Gene amplification
- (b) The degradation of mRNA
- (c) The lac operon
- (d) Transcription

40. It is theoretically possible for a gene from any organism to function in any other organism. Why is this possible?

- (a) All organisms have similar nuclei
- (b) All organisms have the same genetic code
- (c) All organisms are made up of cells
- (d) All organisms have transfer RNA

41. DNA fragments from a gel are transferred to a membrane via a procedure called Southern blotting. The purpose of Southern blotting is to

- (a) Analyze the RFLPs in the DNA
- (b) Separate out the PCR's

(c) Permanently attach the DNA fragments to a substrate

(d) Separate the two complementary DNA strands

42. Influenza viruses require the presence of the nucleus in their host cells because

- (a) They use reverse transcriptase to make a cDNA which is integrated into the host genome
- (b) They scavenge capped fragments from host mRNA in the nucleus to use as primers for viral mRNA
- (c) They use the host RNA polymerase I to transcribe viral mRNAs
- (d) They scavenge poly [A] tails from host mRNAs in the nucleus

43. HIV is the causative agent of AIDS and is a member of the Lentivirus genus of the family Retroviridae. Which of the following features of HIV makes it different from other members of this family?

- (a) HIV uses reverse transcriptase to convert its RNA genome into DNA
- (b) HIV infects human cells that are CD4+
- (c) HIV is enveloped
- (d) The genomic DNA of HIV is 5' capped and 3' polyadenylated

44. Which of the following vectors can carry the longest piece of foreign DNA?

- (a) Plasmids
- (b) Bacteriophage
- (c) Cosmids
- (d) Yeast artificial chromosomes (YACs)

45. DNA and RNA synthesis polymerization [of deoxynucleotides] which takes place

- (a) In a 3' to 5' direction
- (b) In a 5' to 3' direction
- (c) In either (or both) directions
- (d) DNA in 5' to 3' and RNA in 3' to 5'

46. TATA boxes and Pribnow boxes are components of

- (a) Operators
- (b) Promoters
- (c) Enhancers
- (d) Activators

47. The RNA in the cell with the greatest sequence diversity is

- (a) Messenger RNA
- (b) Ribosomal RNA
- (c) Transfer RNA
- (d) (a) and (c)

48. During the overall process of protein synthesis, amino acids become covalently attached to

- a. Messenger RNA
- b. Ribosomal RNA
- c. Transfer RNA
- d. More than one of the above

49. Proteins whose binding to DNA acts to prevent transcription are known as

- (a) Activators
- (b) Operators
- (c) Repressors
- (d) Transcription factors

50. Which of the following genes is not common to all retroviruses?

- (a) *pol* (b) *env*
(c) *src* (d) *gag*

51. The presence of an extra chromosome in a eukaryotic cell is most likely due to

- (a) linkage (b) fertilization
(c) transposition (d) Non-disjunction

52. In fruitflies, the autosomal gene R causes red eyes and an alternative allele r causes white eyes. A testcross is done with a fly that is Rr. What percent of the offspring can be expected to have white eyes?

- (a) 0% (b) 25%
(c) 50% (d) 75%

53. Which of the following is a function of a signal peptide?

- (a) to direct DNA polymerase to a site on DNA
(b) to direct RNA polymerase to a site on DNA
(c) To direct a ribosome to insert a growing protein into the E.R.
(d) to terminate translation on an mRNA

54. Which of the following is incorporated in the model of logistic population growth but NOT in the exponential population growth model?

- (a) change in population size over time
(b) maximum sustainable population size
(c) Population birth rate
(d) population death rate

55. Which of the following is the best example of competitive exclusion?

- (a) two fish species cannot live in the same habitat
(b) an introduced plant species will exclude a similar native species
(c) two parasite species cannot occupy the same host
(d) Two bird species in the same forest cannot use the same set of resources

56. Addition of phosphates containing phosphates can disturb aquatic ecosystems because the phosphate

- (a) kills bacteria (b) poison fish
(c) Stimulate algae growth (d) fertilize crop plants

57. A genetic defect prevents guard cells from closing stomata in the leaves of a plant. This plant will most likely have excessive _____

- (a) CO₂ in its leaves (b) O₂ in its leaves
(c) nitrogen fixation (d) Loss of water

58. A hollow ball of cells best describes a

- (a) Blastula (b) morula
(c) gastrula (d) gamete

59. In a nephron of the human kidney, urea can normally leave the _____ and enter the _____.

- (a) collecting duct / descending loop of Henle
(b) Collecting duct / ascending loop of Henle
(c) ascending loop of Henle / descending loop of Henle
(d) ascending loop of Henle / collecting duct

60. In one complete turn of the Krebs cycle, what is the maximum number of ATP molecules that can be produced in the Krebs cycle itself?

- (a) 0 (b) 1
(c) 2 (d) 3

61. Which of the following do chloroplasts and mitochondria NOT have in common?

- (a) ATP synthase (b) electron transport chain
(c) ATP (d) NADH

62. Microfilaments are part of the structure of

- (a) cilia (b) microtubule
(c) cell cleavage furrows (d) flagella

63. The pH of human blood is slightly basic. Which of the following is most likely to be the pH of human blood?

- (a) 10.6 (b) 7.4
(c) 7.0 (d) 6.4

64. Eukaryotic DNA contains

- (a) single-copy genetically-active DNA
(b) Repetitive and genetically inactive sequences
(c) single-copy, genetically-inactive DNA
(d) repetitive and genetically active sequences

65. Centromeres are directly involved in

- (a) DNA replication (b) transcription
(c) DNA repair (d) chromosome segregation

66. Telomere repeat sequences contain

- (a) (T / A)_n G_n (b) (A / T)_n C_n
(c) (G / C)_n A_n (d) (G / C)_n T_n

67. The transcriptional initiation site usually starts with

- (a) AG (b) GC
(c) AT (d) AC

68. A stretch of double-stranded DNA contains 1000 base pairs, and its base composition is 71 % G + C. How many thymine residues are in this region of DNA?

- (a) 270 (b) 280
(c) 290 (d) 300

69. A 5-month-old male presents with seizures and delayed development. Upon newborn screen he was detected to have hyper phenyl alaninemia and is on a phenylalanine-restricted, synthetic diet. The most likely cause for his current symptoms is a

- (a) defect in tetrahydrofolate reductase
(b) defect in dihydropteridine reductase
(c) tyrosine deficiency
(d) tryptophan deficiency

70. Coding regions of eukaryotic gene that encode polypeptides are called

- (a) hnRNAs
- (b) Exons
- (c) Enhancers
- (d) Leader peptide

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