
CHEMISTRY

Q.1 The molecule having net 'non-zero dipole moment' is

- (A) CCl_4 (B) NF_3 (C) CO_2 (D) BCl_3

Q.2 The Diels-Alder adduct from the reaction between cyclopentadiene and benzyne is



Q.3 The number of possible enantiomeric pair(s) in $\text{HOOC}-\text{CH}(\text{OH})-\text{CH}(\text{OH})-\text{COOH}$ is _____

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

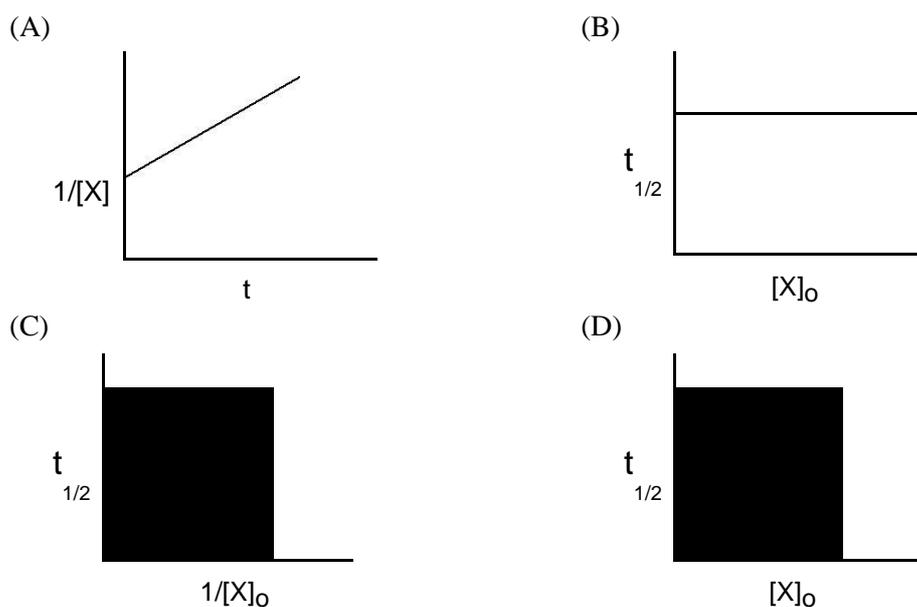
Q.4 For the electrochemical reaction, $\text{Cu}^{2+}(\text{aq}) + \text{Zn}(\text{s}) \rightleftharpoons \text{Cu}(\text{s}) + \text{Zn}^{2+}(\text{aq})$
the equilibrium constant at 25°C is 1.7×10^{37} . The change in standard Gibbs free energy (G°) for this reaction at that temperature will be _____ kJ m l^{-1} (up to one decimal place).

(Given: $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$)

- (A)212 (B) - 212 (C)121 (D) - 121

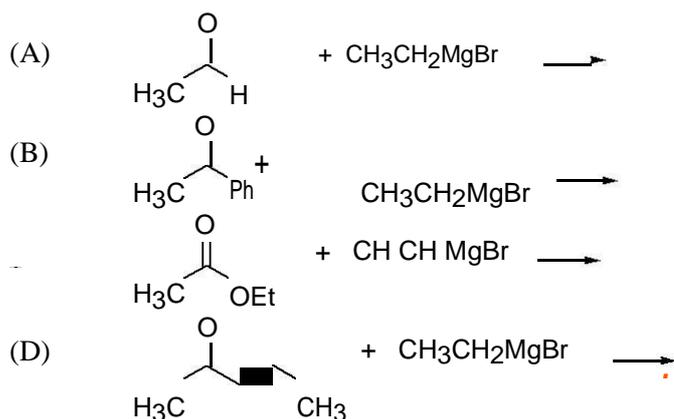
Among the following diagrams, the one that correctly describes a zero order reaction ($\text{X} \rightarrow \text{product}$) is

Q.5 (Given: $[\text{X}] = \text{initial concentration of reactant X}$; $[\text{X}] = \text{concentration of reactant X at time } t$ and $t_{1/2} = \text{half-life period of reactant X}$)

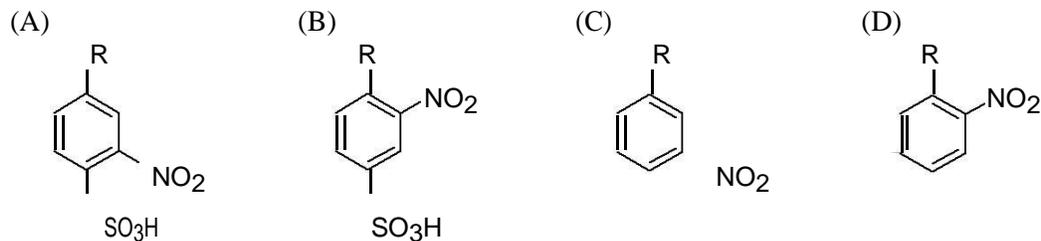
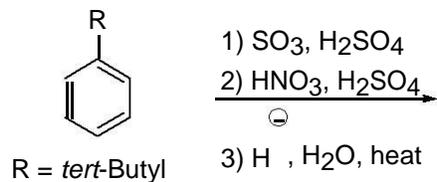


- Q.6 If the radius of first Bohr orbit is 0.53 \AA , then the radius of the third Bohr orbit is
 (A) 2.12 \AA (B) 4.77 \AA (C) 1.59 \AA (D) 3.18 \AA
- Q.7 If 50 mL of 0.02 M HCl is added to 950 mL of H_2O , then the pH of the final solution will be (A) 5 (B) 2 (C) 3 (D) 2.5
- Q.8 Stability of $[\text{CrCl}_6]^{3-}$ (X), $[\text{MnCl}_6]^{3-}$ (Y) and $[\text{FeCl}_6]^{3-}$ (Z) follows the order (Given: Atomic numbers of Cr = 24, Mn = 25 and Fe = 26)
 (A) $X > Y > Z$ (B) $X < Y < Z$ (C) $Y < X < Z$ (D) $X < Y = Z$
- Q.9 Among the following pairs, the paramagnetic and diamagnetic species, respectively, are
 (A) CO and O_2^- (B) NO and CO (C) O_2^{2-} and CO (D) NO^+ and O_2^-
- Q.10 In compounds $\text{K}_4[\text{Fe}(\text{CN})_6]$ (P) and $\text{Fe}(\text{CO})_5$ (Q), the iron metal centre is bonded to
 (A) C of CN^- in P and C of CO in Q
 (B) N of CN^- in P and C of CO in Q
 (C) C of CN^- in P and O of CO in Q
 (D) N of CN^- in P and O of CO in Q

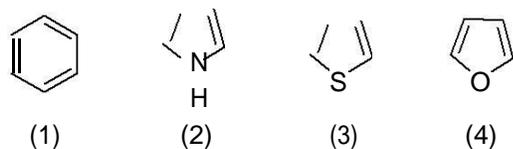
- Q.11 Among the following reactions, the one that produces achiral alcohol (after hydrolysis) is



Q.12 The major product from the following reaction is



13. The order of resonance energy for the following molecules is



- (A) (1) > (3) > (2) > (4) (B) (1) > (3) > (4) > (2)
 (C) (1) > (4) > (2) > (3) (D) (1) > (4) > (3) > (2)

14. The molar enthalpy of vaporization for a liquid (normal boiling point = 78.3 °C) is 39 kJ mol⁻¹. If the liquid has to boil at 25 °C, the pressure must be reduced to _____ Torr (up to one decimal place).

- (A) 59.6 – 60 (B) 65.7 – 66 (C) 69.6 – 70 (D) 75.7 – 76

15. For the process, $\text{H}_2\text{O}(l) \rightleftharpoons \text{H}_2\text{O}(s)$ at 0 °C and 1 atm, the correct statement is

- (A) $S_{\text{system}} = 0$ (B) $S_{\text{total}} > 0$ (C) $S_{\text{total}} = 0$ (D) $S_{\text{total}} < 0$

16. Which one of the following small molecules is a prerequisite for fatty acid oxidation?

- (A) Inositol (B) Choline (C) Carnitine (D) Glycerol

17. 31. The wave number of first line in the balmer series of hydrogen is $15200/\text{cm}$. What is the wave number of balmer series of Be^{3+}
 (A) $2.43 \times 10^5/\text{cm}$ (B) $6.809 \times 10^6/\text{cm}$ (C) $1.14 \times 10^5/\text{cm}$ (D) $1.782 \times 10^6/\text{cm}$
18. Which has the minimum number of unpaired 'd' electrons
 (A) Mn^{2+} (B) Co^{2+} (C) Ni^{2+} (D) Fe^{3+}
19. Which of the following statement does not form part of the Bohr's model
 (A) The electron in the orbit nearest the nucleus has the lowest energy
 (B) The position and velocity of electron cannot be measured simultaneously
 (C) Energy of the electrons in the orbit is quantized
 (D) Electron revolves in different orbit around the nucleus
20. When the electron in the hydrogen atom revolves around the proton in a circular orbit of radius $0.5 \times 10^{-10} \text{m}$, the kinetic energy will be
 (A) $23 \times 10^{-19} \text{J}$ (B) $10 \times 10^{-19} \text{J}$ (C) $1 \times 10^{-19} \text{J}$ (D) $45 \times 10^{-19} \text{J}$
21. In a closed container at 1 atm pressure, 2 moles of $\text{SO}_2(\text{g})$ and 1 mole of $\text{O}_2(\text{g})$ were allowed to react to form $\text{SO}_3(\text{g})$ under the influence of catalyst. At equilibrium it is found that 50% of SO_2 was converted to SO_3 . The partial pressure of O_2 at equilibrium will be
 (A) 0.66 atm (B) 0.493 atm (C) 0.33 atm (D) 0.2 atm
22. The electronic configuration $1s^2, 2s^2, 2p^5, 3s^1$ describes which of the following
 (A) An excited state of F atom (B) Ground state of Ne
 (C) Excited state of O^{2-} (D) ground state of F^- ion
23. When acetone and chloroform are mixed hydrogen bonding takes place between them such a liquid pair will cause
 (A) positive deviation from Raoult's law (B) Negative deviation from Raoult's law
 (C) No deviation from Raoult's law (D) Can not be predicted
24. A maxima or minima obtained in temperature. Composition curve of a mixture of two liquids indicates
 (A) The liquids are immiscible with each other (B) The liquids are partially miscible at maximum or minimum
 (C) An azeotropic mixture (D) A eutectic formation
25. At 291K the molar conductivity at infinite dilution of $\text{NH}_4\text{Cl}, \text{NaOH}, \text{NaCl}$ are 129.8, 217.4, 108.9 $\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$ respectively. If the molar conductivity of centinormal solution of NH_4OH is 9.33 what is the percentage dissociation of NH_4OH at this dilution
 (A) 0.392 (B) 39.2 (C) 3.92 (D) 0.039
26. Through molten AlCl_3 a charge equal to charge of 1 mole N^{3-} was passed. Volume of Cl_2 evolved at anode will be
 (A) 22.4L (B) 67.2L (C) 33.6L (D) 11.2L
27. If the tetrahedral sites in a ccp array of negative ions (B) were half filled with cations (A) the empirical formula of the compound will be
 (A) A_2B_3 (B) A_2B (C) AB_2 (D) AB
28. Van't Hoff factor for a dilute aqueous solution of HCN is 1.00002. The percentage degree of dissociation of the acid is
 (A) 2×10^{-5} (B) 1×10^{-5} (C) 2×10^{-3} (D) 1×10^{-3}
29. Helium was discovered in sun atmosphere by analysing
 (A) Mayer Hoff bands (B) Fraunhofer lines (C) Spectrum (D) Spectrometer
30. For a third order reaction half life is given by
 (A) $t_{1/2} \propto 1/a$ (B) $t_{1/2} \propto 1/a^2$ (C) $t_{1/2} \propto a^2$ (D) $t_{1/2} \propto a$

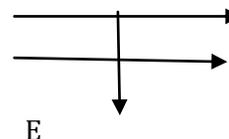
PHYSICS

31. A particle is thrown upward at $t = 0$ sec from ground with a vertical velocity of 100 m/sec. Distance travelled by the particle in 12 sec.: (Take $g = 10 \text{ m/s}^2$)

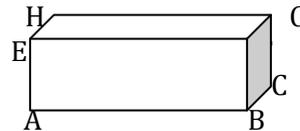
- (A) 0 m (B) 500 m (C) 480 m (D) 520 m

32. An electron enters a magnetic field at right angles to it, as shown in figure. The direction of force acting on the electron will be :

- (A) to the right (B) to the left
 (C) out of the page (D) into the page



33. If the distance between two masses is doubled, the gravitational attraction between them.
 (A) Is doubled (B) Becomes four times (B) Is reduced to half (D) Is reduced to a quarter .
34. A force vector applied on a mass is represented as $F = 6i - 8j + 10k$ and accelerates with 1 m/s^2 . What will be the mass of the body
 (A) $10\sqrt{2} \text{ kg}$ (B) 2 kg (C) 10 kg (D) 20 kg .
35. A particle of mass m at rest is acted upon by a force F for a time T . Its kinetic energy after an interval t is :
 (A) F^2T^2/m (B) $F^2T^2/2m$ (C) $F^2T^2/3m$ (D) $FT/2m$.
36. The displacement-time relationship for a particle is given by $x = a_0 + a_1 t + a_2 t^2$. The acceleration of the particle is
 (A) a_0 (B) a_1 (C) a_2 (D) $2a_2$.
37. Light ray AB incidents on a plane mirror XY at an angle of 50° from normal. The second plane mirror is placed in such a way that the reflected ray BC from the mirror XY retraces its path. Angle of inclination of two mirrors will be:
 (A) 25° (B) 50° (C) 75° (D) 90° .
38. A body moves on three quarters of a circle of radius r . The displacement and distance travelled by it are :
 (A) $r, 3r$ (B) $r\sqrt{2}, 3\pi r/2$ (C) $2r, 3\pi r/2$ (D) $0, 3\pi r/2$.
39. A household electric power outlet (assume 220 V constant voltage) is fused to cut off if the current equals or exceeds 20 Ampere . A 2 kW heater, 1 kW Air conditioner and three 100 W bulbs are already running at rated power. If now somebody wants to run a computer then computer can run without causing fuse to burn if power requirement of computer is (neglect losses in current carrying wire)
 (A) 1000 W (B) 1100 W (C) 1200 W (D) all are correct .
40. Which of the following statements is/are true :
 (A) An electric motor converts mechanical energy into electrical energy.
 (B) An electric generator works on the principle of electromagnetic induction.
 (C) This symbol is used for variable register.
 (D) A wire with a green insulation is usually the live wire of an electric supply. .
41. A cuboid block ($3 \times 2 \times 1$) of mass 12 kg is lying on the ground (Assume air is absent). Take $g = 10 \text{ m/sec}^2$:
 (A) Pressing force applied by the block on the ground is 120 N .
 (B) If the surface $ABCD$ is lying on the ground, then pressure (stress) exerted by the block on the ground will be 20 Pa .
 (C) If surface $ABEF$ is lying on the ground, then the pressure (stress) exerted by the block on the ground will be 60 Pa .
 (D) If we place the block on the ground such that different plane surfaces lie on the ground, pressure (stress) on the ground will be maximum when surface $BCFG$ lies on the ground. .
42. Three resistors each of 30 ohm is connected along three sides of an equilateral triangle. A cell of 2 V is then connected with two adjacent vertices. The current will be
 (A) $1/45 \text{ amp}$. (B) $\text{amp} \cdot 1/15$ (C) $\text{amp} \cdot 1/10$ (D) $1/5 \text{ amp}$.
43. A particle moves from position $r_1 = 3i + 2j - 6k$ to position $r_2 = 14i + 13j + 9k$ under the action of force $4i + j + 3k$. The work done by this force will be
 (A) 100 J (B) 50 J (C) 200 J (D) 75 J .
44. Two particles of combined mass M , placed in space with certain separation, are released. Interaction between the particles is only of gravitational nature and there is no external force present. Acceleration of one particle with respect to the other when separation between them is R , has a magnitude
 (A) $GM/2R^2$ (B) GM/R^2 (C) $2GM/R^2$ (D) not possible to calculate due to lack of information .
45. In the figure shown $ABCD$ is a rectangular smooth tube kept fixed in a vertical plane. A particle is projected from point A to reach point C with some speed. At the corners B and D velocity changes its direction by 90° without any change of its magnitude at that corner. If time taken on paths ABC and ADC are t_1 and t_2 respectively, then: (given $l > b$)
 (A) $t_1 = t_2$ (B) $t_1 > t_2$ (C) $t_1 < t_2$ (D) none of these .



46. Two point masses of mass m_1 and m_2 are placed at point A and B respectively as shown in figure. Point A is the centre of hollow sphere of uniformly distributed total mass m_3 . Consider only gravitational interaction between all masses and neglect other gravitational forces. Select the **incorrect** alternative.

- (A) Hollow sphere and point mass m_1 moves with same acceleration.
 (B) m_1 and m_2 moves with same acceleration. (C) Net force on m_1 is non-zero
 (D) Net force on hollow sphere and point mass m_1 as a system is equal to force experienced by point mass m_2 in magnitude.

47. A bullet of mass 10 g is fired with a rifle. The bullet takes 0.003 s to move through its barrel and leaves with a velocity of 300 ms⁻¹. The force exerted on the bullet by the rifle :

- (A) 103 N (B) 104 N (C) 105 N (D) zero

48. A machine gun fires n bullets per second and the mass of each bullet is m . If the speed of bullet is v , then the magnitude of force exerted on the machine gun is :

- (A) mng (B) mnv/g (C) mnv (D) $mnvg$

49. An unnumbered clock shows time as 4 : 35 in its mirror image. The real time is :

- (A) 8 : 25 (B) 6 : 25 (C) 7 : 25 (D) None of these

50. A particle is projected from point 'A' with velocity u at an angle of 45° with the horizontal as shown in the figure. It strikes the inclined plane BC at right angle. The velocity of the particle just before the collision with the inclined is :

- (A) $\sqrt{3} u/2$ (B) $u/2$ (C) $2u/\sqrt{3}$ (D) u

51. Two identical balls P and Q moving in the x - y plane collide at the origin ($x = 0, y = 0$) of the coordinate system. Their velocity components just before the moment of impact were, for ball P, $v_x = 6$ m/s, $v_y = 0$; for ball Q, $v_x = 5$ m/s, $v_y = 2$ m/s

As a result of the collision, the ball P comes to rest. The velocity components of the ball Q just after collision will be:

- (A) $v_y = 1$ m/s (B) $v_y = \sqrt{2}$ m/s (C) $v_x = \sqrt{2}$ m/s (D) $v_x = 1$ m/s

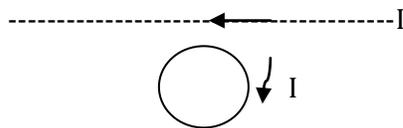
52. Which of the following is not possible for an object of mass 5kg which is released from height 15m.

(Take $g = 10$ m/s²) KE = Kinetic Energy of the object, PE = Potential Energy)

- (A) KE = 600 J ; PE = 150 J (B) KE = 150 J ; PE = 600 J

- (C) KE = 0 J ; PE = 750 J (D) KE = 800 J ; PE = - 50 J

53. The radius of a coil of wire with N turns is 0.22 m, and 3.5 A current flows clockwise in the coil as shown. A long straight wire carrying a current 54A toward the left is located 0.05 m from the edge of the coil. The magnetic field at the centre of the coil is zero tesla. The number of turns N in the coil are :



- (A) 4 (B) 6 (C) 7 (D) 8

54. A conducting rod of length l is moved at constant velocity ' v_0 ' on two parallel, conducting, smooth, fixed rails, that are placed in a uniform constant magnetic field B perpendicular to the plane of the rails. A resistance R is connected between the two ends of the rail. Then which of the following is/are incorrect :

- (A) The thermal power dissipated in the resistor is equal to rate of work done by external person pulling the rod.

- (B) If applied external force is doubled than a part of external power increases the velocity of rod.

- (C) Lenz's Law is not satisfied if the rod is accelerated by external force

- (D) If resistance R is doubled then power required to maintain the constant velocity v_0 becomes half.

55. The charge on a capacitor decreases N times in time t , when it discharges through a circuit with a time constant T

- (A) $t = NT$ (B) $t = T \ln(N)$ (C) $t = T(\ln N - 1)$ (D) $t = T \ln(1 - 1/N)$

56. Two coherent monochromatic light beams of intensities I and $4I$ are superimposed. The maximum and minimum possible intensities in the resulting beam are

- (A) $5I$ and I (B) $5I$ and $3I$ (C) $9I$ and I (D) $9I$ and $3I$

57. An astronomical telescope in normal adjustment receives light from a distant source S . The tube length is now decreased slightly

- (A) A virtual image of S will be formed at finite distance (B) No image will be formed

- (C) A small real image S will be formed behind eyepiece (D) A large real image will be formed far away from eyepiece .
58. A point source of light at the surface of a sphere causes a parallel beam of light to emerge from the opposite surface of the sphere. The refractive index of the sphere is
 (A) 1.5 (B) $\frac{5}{3}$ (C) 2 (D) 2.5 .
59. A transverse sinusoidal wave of amplitude A wavelength λ and frequency f is travelling on a stretched string. The maximum speed of any point on the string is $v/10$, where v is the speed of propagation of wave. If $A=10^{-3}$ m and $v=10$ m/s then λ and f are given by
 (A) $\lambda = 2\pi \times 10^{-2}$ m (B) $\lambda = 10^{-3}$ m (C) $f = 10^3/\pi$ Hz (D) $f = 10^3$ Hz .
60. When we hear a sound we can identify its source from
 (A) the frequency of the sound (B) the amplitude of the sound (C) the wavelength of the sound
 (D) the overtone present in the sound .

BIOLOGY

61. Tendril of Cucurbita and thorn of Bougainvillea are
 (A) Vestigial organ (B) Analogous organ (C) Homologous organ (D) None of these .
62. Select the wrong pair
 (A) Haldane – hot dilute soup (B) Oparin – protobiont
 (C) Fox – coacervates (D) Spallanzani abiogenesis .
63. Which of the following is not vestigial in man?
 (A) Tail vertebrae (B) Nails (C) Nictitating membrane (D) Vermiform appendix .
64. Hardy – Weinberg operates in the absence of
 (A) Mutation (B) Natural selection (C) Recombination (D) all of these .
65. Name given to fossil hominid of Shivalik hills in INDIA is
 (A) Ramapithecus (B) Australopithecus (C) Pithecanthropus (D) Neanderthalensis .
66. Removal of Ringwood tissue outside the vascular cambium from the tree trunk kills it because
 (A) Water cannot move up (B) Food does not travel down
 (C) Shoot becomes starved (D) Annual rings are not produced .
67. Caspary strip is a characteristic feature of
 (A) Pericycle (B) Periblem (C) Endodermis (D) Hypodermis .
68. Bulliform seeds are found in
 (A) Seeds of sunflower (B) Leaf of wheat (C) Pod of pea (D) Tuber of potato .
69. When a plasmolysed cell is placed in a hypertonic solution then water will move inside the cell. Which force causes this
 (A) DPD (B) OP (C) WP (D) None of these .
70. Sunken stomata is found in
 (A) Trifolium (B) Lemna (C) Nerium (D) Lilium .
71. Which crop utilizes solar energy most efficiently?
 (A) Potato (B) Sugarcane (C) Wheat (D) Rice .
72. is a CAM plant
 (A) Maize (B) Pineapple (C) Onion (D) Pea .
73. The plant part which consists of two generations one within the other is
 (A) Germinated pollen grains (B) Embryo (C) Unfertilised ovule (D) Seed .
74. One of the most resistant known biological materials is
 (A) Lignin (B) Hemicellulose (C) Sporopollenin (D) Lignocellulose .
75. Exine of pollen grains is made up of
 (A) Pectocellulose (B) Lignocellulose (C) Sporopollenin (D) Pollen kit .
76. Acrosome of sperm is formed from _____ of spermatid
 (A) Nucleus (B) Centrosome (C) Mitochondria (D) Golgi complex .
77. Sertoli cells are found in
 (A) Seminiferous tubules (B) Ovarian follicles (C) Uriniferous tubules (D) Small intestine .

78. Bartholin's gland in female correspond to which gland in male?
 (A) Cowper's gland (B) Inguinal gland (C) Rectal gland (D) Prostate gland .
79. On selfing RrTt we produce to 400 plants, find out number of plants with genotype RrTt
 (A) 100 (B) 225 (C) 50 (D) 300 .
80. Which one of the following is not a mendelian disorder?
 (A) Sickle cell anaemia (B) Colour blindness (C) Cystic fibrosis (D) Turner's syndrome .
81. Action of UV rays on DNA is
 (A) Formation of thymine dimer (B) Deletion of base pair
 (C) Addition of base pair (D) Methylation of base pair .
82. Out of 64 codons only 61 code for 20 different amino acids. This character of genetic code is called
 (A) Degeneracy (B) Non ambiguous nature (C) Redundancy (D) Overlapping .
83. Among the following the mutagenic agent is
 (A) Ethyl methane (B) Ethylene (C) 2,4-D (D) IAA .
84. At 5' end of a polynucleotide chain
 (A) - OH group is attached (B) Phosphate group is attached
 (C) Pentose sugar is attached (D) H - bond is present .
85. A - A single mRNA strand is capable of forming a number of different polypeptide chains.
 R - The mRNA chain has terminator codons.
 (A) If both A and R is true R is the correct explanation of A
 (B) If both A and R is true R is not the correct explanation of A
 (C) If A is true but R is false (D) If both A and R is false .
86. In tumour introducing capacity of Agrobacterium tumefaciens is located in large extra chromosomal plasmids called
 (A) Ri plasmid (B) Lambda phage (C) pBR322 (D) Ti plasmid .
87. A transgenic food crop, which may help in solving the problem of night blindness in developing countries
 (A) Flavr savr tomatoes (B) Starlink maize (C) Bt soyabean (D) Golden rice .
88. GAATTC is the recognition site for the restriction endonuclease
 (A) EcoRI (B) Hind II (C) Eco R II (D) Bam HI .
89. If the strong partner is benefitted and weak partner is damaged, it is known as
 (A) Predation (B) Allelopathy (C) Symbiosis (D) Commensalism .
90. Of the total incident solar radiation the proportion of PAR is
 (A) About 70% (B) About 60% (C) Less than 50% (D) More than 80% .
91. XO chromosomal abnormality in hum. causes
 (A) Turner's syndrome (B) Down syndrome (C) Darwin's syndrome (D) Klinefelter syndrome .
92. Feeding jiggery with lime water is one of the first aid measure for
 (A) Anthrax (B) Cowpox (C) Diarrhoea (D) Milk fever .
93. There are three genes a,b,c percentage of crossing over between a and b is 20%, b and c is 28% and a and c is 8%. What is the sequence of gene in the chromosome
 (A) a,b,c (B) b,a,c (C) c,b,a (D) none of these .
94. Vitamin C was the first vitamin to be produced by a fermentation process by using
 (A) Penicillium (B) E.coli (C) Yersinia pestis (D) Acetobactor .
95. The RQ of a germinating castor seed is
 (A) Equal to one (B) Greater than one (C) Less than one (D) Equal to zero .
96. In flagella membrane which enzyme catalyses ATP activity
 (A) Cytoplasmic dynein (B) Asconic dynein (C) Kinesis (D) Myosin .
97. Which one of the following other than microscopy is used for study of cell?
 (A) Maceration (B) Plasmolysis (C) Chromatography (D) Autoradiography .
98. What is mitoplast?
 (A) Membraneless mitochondria (B) Another name of mitochondria
 (C) Mitochondria without outer membrane (D) Mitochondria without inner membrane .
99. Acoelus vertebrae in frog if
 (A) 5th vertebrae (B) Atlas vertebrae (C) 8th vertebrae (D) None of these .
100. Which ribs show 'bucket handle' type of movement?
 (A) Rib no 1 - 2 (B) Rib no 3 - 5 (C) Rib no 6 - 10 (D) Rib no 11 - 12 .

