Total Questions : 200 **Max. Time : 3 ½ hrs.**

Instructions

1. Each question has four options. Mark the most appropriate choice as correct answer.
2. Follow the instructions for answering, given on the OMR sheet and BACK page of Admit Card.
3. Enter your Roll Number, Serial No. of OMR answer sheet, full signature and name in the spaces provided on the question paper, duplicate face sheet, answer sheet and attendance list.
4. Use only blue or black ball point pen for writing/marking
5. For each correct answer, one mark will be awarded. Each incorrect answer will be awarded one third $\left(-\frac{1}{3}\right)$ negative mark. Zero Mark will be given for question not answered. Any answer having more than one entry, will be treated as wrong answer and awarded negative mark.
6. Do not mark or write anything on the question booklet
7. Any candidate found removing page(s) and/or copying down questions or using unfair means will be disqualified. Pager, cellular phone, calculator or any such electronic devices are strictly prohibited in the examination hall.
8. Any discrepancy or ambiguity in any question may be reported to Sub - Dean (Exams) in writing within 72 hours. No notice will be taken of representations received after 72 hours
9. No candidate will be allowed to leave the Hall until
   (1) Three and half hours have elapsed after the start of the Examination
   (2) The answer sheet is countersigned by both the Invigilators
   (3) The Invigilator in your hall has taken your signature in the attendance list.

PHYSICS

1. If the cold junction of a thermo-couple is kept at 0°C and the hot junction is kept at T°C, then the relation between neutral temperature (T_n) and temperature of inversion (T_i) is

(1) $T_n = \frac{T_i}{2}$ (2) $T_n = 2T_i$

(3) $T_n = T_i - T$ (4) $T_n = T_i + T$

2. In radioactive decay process, the negatively charged emitted β -particles are

(1) the electrons present inside the nucleus

(2) the electrons produced as a result of the decay of neutrons inside the nucleus

(3) the electrons produced as a result of collisions between atoms

(4) the electrons orbiting around the nucleus

3. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane . Its coordinates at a later time are $(\sqrt{3}, 3)$. The path of the particle makes with the x-axis an angle of

(1) 30° (2) 45°

(3) 60° (4) 0°

4. The resistance of an ammeter is 13 Ω and its scale is graduated for a current upto 100 A. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750A by this meter . The value of shunt resistance is

(1) 20 Ω (2) 2 Ω

(3) 0.2 Ω (4) 2 k Ω

5. The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic fluxϕ linked with the primary coil is given by $\phi = \phi_o + 4t$, where ϕ is in weber, t is time in second and ϕ_o is a constant, the output voltage across the secondary coil is

(1) 90 V (2) 120 V

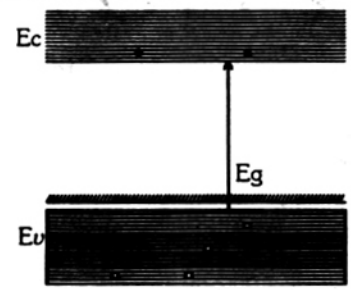
(3) 220 V (4) 30 V

6. A particle executes simple harmonic oscillation with an amplitude 'a'. The period of oscillation is 'T'. The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is

(1) $\frac{T}{4}$ (2) $\frac{T}{8}$

(3) $\frac{T}{12}$ (4) $\frac{T}{2}$

7. In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively. The material is a / an



(1) p-type semiconductor
(2) insulator (3) metal
(4) n-type semiconductor

8. Two radioactive substances A and B have decay constants 5λ and λ respectively. At t = 0 they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $\left(\frac{1}{e}\right)^2$ after a time interval

(1) $\frac{1}{4\lambda}$ (2) 4λ

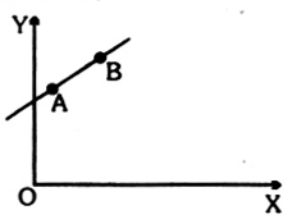
(3) 2λ (4) $\frac{1}{2\lambda}$

9. A charged particle (charge q) is moving in a circle of radius R with uniform speed v. The associated magnetic moment μ is given by

(1) $\frac{qvR}{2}$ (2) qvR^2

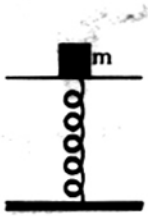
(3) $\frac{qvR^2}{2}$ (4) qvR

10. A particle of mass m moves in the XY plane with a velocity 'v' along the straight line AB. If the angular momentum of the particle with respect to origin O is L_A when it is at A and L_B when it is at B, then



(1) $L_A > L_B$ (2) $L_A = L_B$
(3) the relationship between L_A and L_B depends upon the slope of the line AB
(4) $L_A < L_B$

11. A mass of 2.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible . When pressed slightly and released and mass executes a simple harmonic motion.



The spring constant is 200 N/m . What should be he minimum amplitude of the motion, so that the mass gets detached from the pan? (Take g = 10 m/s^2)

(1) 8.0 cm (2) 10.0 cm
(3) Any value less than 12.0 cm
(4) 4.0 cm

12. A beam of electrons passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move

(1) in an elliptical orbit
(2) in a circular orbit (3) along a parabolic path
(4) along a straight line

13. A common emitter amplifier has a voltage gain of 50, an input impedance of 100Ω and an output impedance of 200Ω . The power gain of the amplifier is

(1) 500 (2) 1000
(3) 1250 (4) 100

14. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is

(1) 0.5 π (2) π (3) 0.707π (4) zero

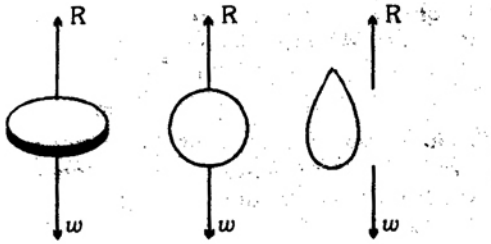
15. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be

(1) $[ML^2T^{-3}I^{-1}]$ (2) $[ML^2T^{-2}]$
(3) $[ML^2T^{-1}I^{-1}]$ (4) $[ML^2T^{-3}I^{-2}]$

16. Specific rotation of sugar solution is 0.01 S.I. units 200 kg-m^{-3} of impure sugar solution is taken in a polarimeter tube of length 0.25m and optical rotation of 0.4 rad is observed. The percentage of purity of sugar in the sample is

(1) 11 % (2) 20 % (3) 80 % (4) 89 %

17. When a body falls in air, the resistance of air depends to a great extent on the shape of the body. Three different shapes are given . Identify the combination of air resistances which truly represents the physical situation? (The cross - sectional areas are the same)



(1) disc (2) ball (3) cigar shaped

(1) $1 < 2 < 3$ (2) $2 < 3 < 1$

(3) $3 < 2 < 1$ (4) $3 < 1 < 2$

18. A beam of parallel rays is brought to focus by a plano-convex lens . A thin concave lens of the same focal length is joined to the first lens .The effect of this is

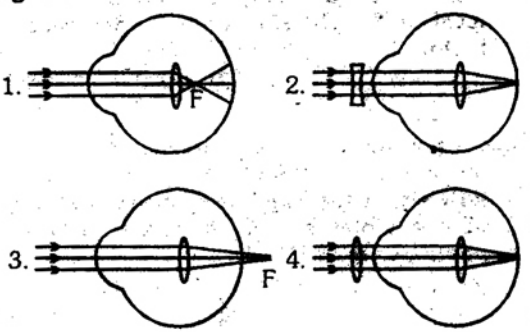
(1) the focus shifts to infinity

(2) the focal point shifts towards the lens by a small distance

(3) the focal point shifts away from the lens by a small distance

(4) the focus remains undisturbed

19. Identify the wrong description of the below figures



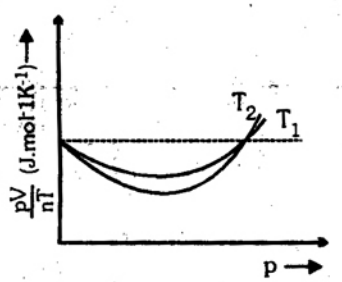
(1) 1 represents far- sightedness

(2) 2 correction for short -sightedness

(3) 3 represents far - sightedness

(4) 4 correction for far - sightedness

20.



The figure shows the plot of $\frac{pV}{nT}$ versus p for oxygen gas at two different temperatures.

Read the following statements concerning the given curves

(i) The dotted line corresponds to the 'ideal' gas behaviour

(ii) $T_1 > T_2$

(iii) The value of $\frac{pV}{nT}$ at the point where the curves meet on the y-axis is the same for all gases.

Which of the above statements is true?

(1) (i) only (2) (i) and (ii) only

(3) All of the above (4) None of the above

21. A ray of light is incident on the surface of a glass plate of thickness t. If the angle of incidence θ is small, the emerging ray would be displaced side ways by an amount [Take n = refractive index of glass]

(1) $t\theta\, n/(n+1)$ (2) $t\theta(n-1)/n$

(3) $t\theta\, n/(n-1)$ (4) $t\theta(n+1)/n$

22. An asteroid of mass m is approaching earth, initially at a distance of $10R_e$ with speed v_i .It hits the earth with a speed v_f (R_e and M_e are radius and mass of earth), then

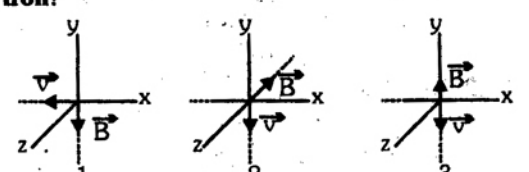
(1) $v_f^2 = v_i^2 + \frac{2Gm}{M_eR}\left(1 - \frac{1}{10}\right)$

(2) $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1 + \frac{1}{10}\right)$

(3) $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1 - \frac{1}{10}\right)$

(4) $v_f^2 = v_i^2 + \frac{2GM}{R_e}\left(1 - \frac{1}{10}\right)$

23. The figure shows three situations when an electron with velocity $\vec{v}$ travels through a uniform magnetic field $\vec{B}$. In each case, what is the direction of magnetic force on the electron?



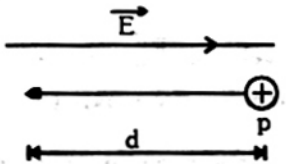
(1) + ve z – axis, – ve x– axis, + ve y – axis

(2) – ve z – axis, + ve x– axis and zero

(3) + ve z – axis ,+ ve y – axis and zero

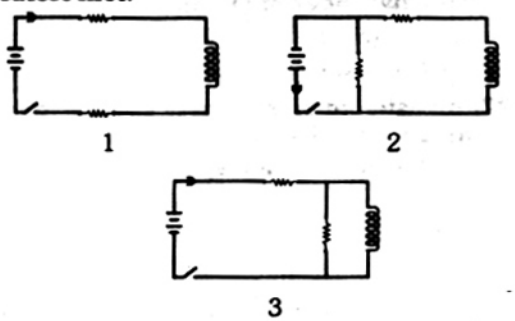
(4) – ve z – axis, + ve x– axis and zero

24. In the figure, a proton moves a distanced d in a uniform electric $\vec{E}$ as shown in the figure Does the electric field do a positive or negative work on the proton? Does the electric potential energy of the proton increase or decrease?



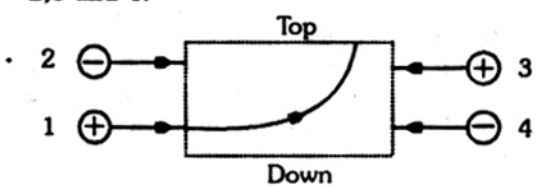
(1) Negative, increase (2) Positive, decrease
(3) Negative, decrease (4) Positive, increase

25. The figure shows three circuits with identical batteries, inductors and resistance. Rank the circuits according to the currents through the battery just after the switch is closed, greatest first.



(1) $i_2 > i_3 > i_1$ (2) $i_2 > i_1 > i_3$
(3) $i_1 > i_2 > i_3$ (4) $i_1 > i_3 > i_2$

26. The figure shows the path of a positively charged particle 1 through a rectangular region of uniform electric field as shown in the figure. What is the direction of electric field and the direction of deflection of particles 2,3 and 4?

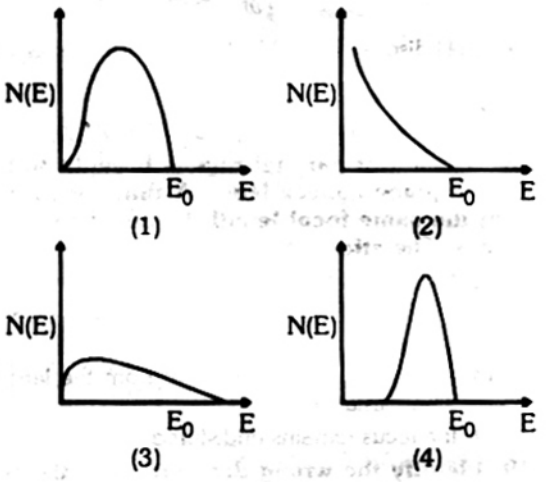


(1) Top ; down, top down
(2) Top ; down, down, top
(3) Down ; top, top ; down
(4) Down ; top, down, down

27. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It rolls down a smooth surface to the ground, then climbs up another hill of height 30 m and finally rolls down to a horizontal base at a height of 20 m above the ground . The velocity attained by the ball is

(1) 40 m / s (2) 20 m / s
(3) 10 m / s (4) $10\sqrt{30}$ m / s

28. The energy spectrum of β - particles [number N (E) as a function of β - energy E] emitted from a radioactive source is



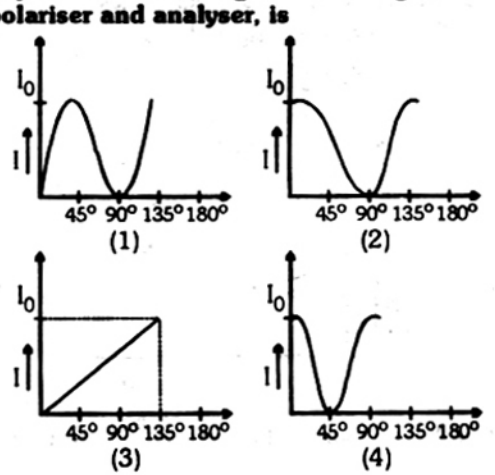
29. A sound absorber attenuates the sound level by 20 dB. The intensity decreases by a factor of

(1) 1000 (2) 10000
(3) 10 (4) 100

30. A parallel plate capacitor is made by stacking n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is C, then the resultant capacitance is

(1) (n – 1) C (2) (n + 1) C
(3) C (4) nC

31. The graph showing the dependence of intensity of transmitted light on the angle between polariser and analyser, is



32. In a detector output circuit consists of R = 10 k Ω and C=100μ F. The frequency of carrier signal it can detect is

(1) >> 1MHz (2) 0.1kHz

(3) >> 1 GHz (4) 10^3 Hz

33. A six pole generator with fixed field excitation develops an emf of 100 V, when operating at 1500 rpm. At what speed must it rotate to develop 120 V?

(1) 1200 rpm (2) 1800 rpm

(3) 1500 rpm (4) 400 rpm

34. Energy from the sun is received on earth at the rate of 2 cal per cm^2 per min. If average wavelength of solar light be taken at 5500 Å then how many photons are received on the earth per cm^2 per min?

(h = 6.6 x 10^{-34} J–s, 1 cal = 4.2 J)

(1) 1.5 x 10^{13} (2) 2.9 x 10^{13}

(3) 2.3 x 10^{19} (4) 1.75 x 10^{19}

35. An X-ray pulse of wavelength 4.9 Å is sent through a section of Wilson cloud chamber containing a super saturated gas, and tracks of photoelectron ejected from the gaseous atoms are observed. Two groups of tracks of lengths 1.40 cm and 2.02 cm are noted. If the range-energy relation for cloud chamber is given by R = α E with α =1 cm / keV, obtain the binding energies of the two levels from which electrons are emitted. Given h = 6.63 x 10^{-34}J–s,e = 1.6 x 10^{-19}J .

(1) 0.52 keV (2) 0.75 eV

(3) 0.52 eV (4) 0.75 keV

36. A beam of 35.0 keV electrons strikes a molybdenum target, generating the X-rays. What is the cutoff wavelength?

(1) 35.5 pm (2) 40.0 pm

(3) 15.95 pm (4) 18.2 pm

37. We have seen that a gamma-ray dose of 3 Gy is lethal to half the people exposed to it. If the equivalent energy were absorbed as heat, what rise in body temperature would result?

(1) 300 μ K (2) 700 μ K

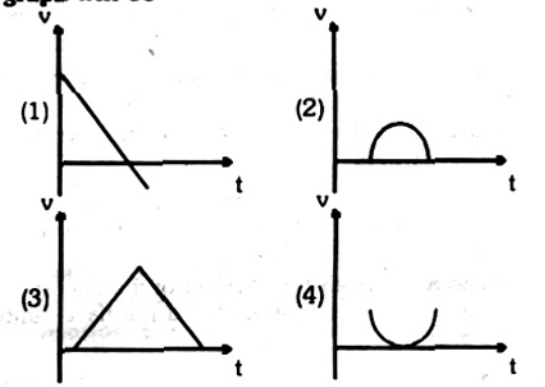
(3) 455 μ K (4) 390 μ K

38. Mass spectrometric analysis of potassium and argon atoms in a Moon rock sample shows that the ratio of the number of (stable)^{40} Ar atoms present to the number of (radioactive)^{40} K atoms is 10.3. Assume that all the argon atoms were produced by the decay of potassium atoms, with a half-life of 1.25 x 10^9 yr. How old is the rock?

(1) 2. 95 x 10^{11} yr (2) 2 .95 x 10^9 yr

(3) 4 .37 x 10^9 yr (4) 4 .37 x 10^{11} yr

39. A particle is thrown above, then correct v - t graph will be



40. The speed (v) of ripples on the surface of water depends on surface tension (σ), density ((ρ) and wavelength (λ). The square of speed (v) is proportional to

(1) $\frac{\sigma}{\rho\lambda}$ (2) $\frac{\rho}{\sigma\lambda}$

(3) $\frac{\lambda}{\sigma\rho}$ (4) ρλσ

§ ***Directions for Q. 41 to Q.60 : In each of the following questions a statement of Assertion is given followed by a corresponding statement of Reason just below it . Of the statements mark the correct answer as***

(1) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion

(2) If both Assertion and Reason are true but the Reason is not the correct explanation of Assertion

(3) If Assertion is true but Reason is false

(4) If both Assertion and Reason are false

41 . Assertion : A ladder is more apt to slip, when you are high up on it than when you just begin to climb.

Reason : At the high up on a ladder, the torque is large and on climbing up the torque is small

42 : Assertion : Water in a U-tube executes SHM, the time period for mercury filled up to the same height in the U-tube be greater than that in case of water.

Reason : The amplitude of an oscillating pendulum goes on increasing.

43 : Assertion : In taking into account the fact that any object which floats must have an average density less than that of water, during world war I, a number of cargo vessels are made of concrete.

Reason : Concrete cargo vessels were filled with air .

44 : Assertion : A portable AM radio set must be kept horizontal to receive the signals properly.

Reason : Radio waves are polarised electromagnetic waves

45 : Assertion : If earth did not have atmosphere, its average surface temperature would be lower than what is now.

Reason : Green house effect of the atmosphere would be absent if earth did not have atmosphere .

46. Assertion : Light emitting diode (LED) emits spontaneous radiation .

Reason : LED are forward biased p–n junctions .

47 : Assertion : Optical fibre communication has immunity to cross-talk.

Reason : Optical interference between fibres is zero .

48 : Assertion : The knowledge of Albedo helps us to estimate the atmosphere of a planet.

Reason : The clouds are not good reflectors of light.

49 . Assertion : The energy gap between the valence band and conduction band is greater in silicon than in germanium .

Reason : Thermal energy produces fewer minority carriers in silicon than in germanium.

50 Assertion : The pattern and position of fringes always remain same even after the introduction of transparent medium in a path of one of the slits .

Reason : The central fringe is bright or dark does not depend upon the initial phase difference between the two coherence sources.

51 . Assertion : A biconvex lens of focal length 10 cm is split into two equal parts by a plane parallel to its principal axis. The focal length of the each part will be 20cm.

Reason : Focal length does not depend on the radii of curvature of two surfaces.

52 . Assertion : The acceleration of a body down a rough inclined plane is greater than the acceleration due to gravity .

Reason : The body is able to slide on a inclined plane only when its acceleration is greater than acceleration due to gravity.

53 . Assertion : Transmission Electron Microscope (TEM) provides two dimensional images.

Reason : Scanning Electron Microscope (SEM) provides three dimensional images.

54 . Assertion : While measuring the thermal conductivity of liquid experimentally, the upper layer is kept hot and the lower layer is kept cold .

Reason : This avoids heating of liquid by convection .

55 . Assertion : The temperature of the surface of the sun is approximately 6000 K. If we take a big lens and focus the sun rays, we can produce a temperature of 8000 K.

Reason : This highest temperature can be produced according to second law of thermodynamics.

56 . Assertion : Air pressure in a car tyre increases during driving .

Reason : Absolute zero temperature is not zero energy temperature.

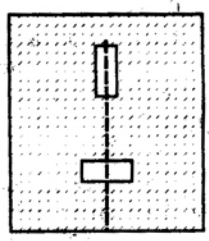
57 . Assertion : Ocean waves hitting a beach are always found to be nearly normal to the shore .

Reason : Ocean waves hitting a beach are assumed as plane waves .

58 . Assertion : The lightning conductor at the top of high building has sharp pointed ends .

Reason : The surface density of charge at sharp points is very high resulting in setting up of electric wind .

59 . Assertion : Two short magnets are placed on a cork which floats on water. The magnets are placed such that the axis of one produced bisects the axis of other at right angles. Then the cork has neither translational nor rotational motion.



Reason : Net force on the cork is zero .

60 . Assertion : The speed of whirlwind in a tornado is alarmingly high .

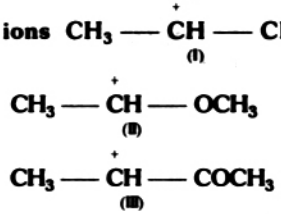
Reason : If no external torque acts on a body, its angular velocity remains conserved.

61. What is the product obtained when chlorine reacts with ethyl alcohol in the presence of NaOH ?

(1) CH_3Cl (2) C_2H_5Cl

(3) CCl_3CHO (4) $CHCl_3$

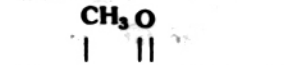
62. The decreasing order of the stability of the ions



(1) I > II > III (2) III > II > I

(3) II > III > I (4) II > I > III

63. The IUPAC name of



is

(1) 1-hydroxy-4-methyl pentan-3-one

(2) 2-methyl-5-hydroxy pentan-3-one

(3)4-methyl-3-oxopentan-1-ol

(4) Hexan-1-ol-3-one

64. Litharge is chemically

(1) PbO (2) PbO_2

(3) Pb_3O_4 (4) $Pb(CH_3COO)_2$

65. The half-life for the reaction

$N_2O_5 \longrightarrow 2NO_2 + \frac{1}{2}O_2$ **is 2.4 h at STP.**

Starting with 10.8 g of N_2O_5 how much oxygen will be obtained after a period of 9.6 h?

(1) 1.5 L (2) 3.36 L

(3) 1.05 L (4) 0.07 L

66. Planar structure is shown by

(1) CO_3^{2-} (2) BCl_3

(3) $N(SiH_3)_3$ (4) all of these

67. The correct order of basic strength is

(1) $H_2O < OH^- < CH_3OH < CH_3O^-$

(2) $CH_3OH < H_2O < CH_3O^- < OH^-$

(3) $H_2O < CH_3OH < OH^- < CH_3O^-$

(4) $OH^- < H_2O < CH_3O^- < CH_3OH$

68. If AgI crystallises in zinc blende structure with I^- ions at lattice points. What fraction of tetrahedral voids is occupied by Ag^+ ions?

(1) 25% (2) 50%

(3) 100% (4) 75%

69. The density of air is 0.001293 g/ cc at STP. Its vapour density is

(1) 0.001293 (2) 8.2786

(3) 14.49 (4) 6.2706

70. The solubility product of As_2O_3 is 10.8×10^{-9}. It is 50% dissociated in saturated solution .The solubility of salt is

(1) 10^{-2} (2) 2×10^{-2}

(3) 5×10^{-3} (4) 5.4×10^{-9}

71. The temperature dependence of rate constant (K) of a chemical reaction is written in terms of Arrhenius equation $k = Ae^{-E_a/RT}$ Activation energy (E_a) of the reaction can be calculated by plotting

(1) log k vs T (2) log k vs $\frac{1}{T}$

(3) k vs T (4) k vs $\frac{1}{\log T}$

72. Which one of the following is the true covalent oxide of iodine?

(1) I_2O_4 (2) I_2O_5 (3) I_2O_7 (4) I_2O_9

73. When H_2S gas is passed through the HCl containing aqueous solution of $CuCl_2$, $HgCl_2$, $BiCl_3$ and $CoCl_2$, it does not precipitate out

(1) CuS (2) HgS

(3) Bi_2S_3 (4) CoS

74. The species having tetrahedral shape is

(1) $[PdCl_4]^{2-}$ (2) $[Ni(CN)_4]^{2-}$

(3) $Pd(CN_4)]^{3-}$ (4) $[NiCl_4]^{2-}$

75. The basic character of the transition metal monoxide follows the order

(1) VO > CrO > TiO > FeO

(2) CrO > VO > FeO> TiO

(3) TiO > FeO > VO > CrO

(4) TiO > VO > CrO > FeO

76. Which of the following does not exist as a Zwitter ion?

(1) Glycine (2) Glutamic acid

(3) Sulphanilic acid (4) p-aminobenzoic acid

77. The hydrocarbon which does decolourise alkaline $KMnO_4$ solution and also does not give any precipitate with ammoniacal silver nitrate is

(1) benzene (2) acetylene

(3) propyne (4) butyne-1

78. Plexiglas is a commercial name of

(1) glyptal (2) polyacrylo nitrile

(3) polymethyl methacrylate
(4) polyethyl acrylate

79. One mole of methanol when burnt in O_2, gives out 723 kJ mol^{-1} heat. If one mole of O_2 is used, what will be the amount of heat evolved?
(1) 723 kJ (2) 924 k J
(3) 482 kJ (4) 241 kJ

80. The enthalpy of hydrogenation of cyclohexene is 119.5 kJ mol^{-1}. If resonance energy of benzene is –150.4 kJ mol^{-1}, its enthalpy of hydrogenation would be
(1) – 208.1 kJ mol^{-1}
(2) – 269.9 kJ mol^{-1} (3) – 358.5 kJ mol^{-1}
(4) – 508 .9 kJ mol^{-1}

81. A current of 96.5 A is passed for 18 min between nickel electrodes in 500 mL solution of 2M $Ni(NO_3)_2$. The molarity of solution after electrolysis would be
(1) 0.46 M (2) 0.92 M
(3) 0.625 M (4) 1.25 M

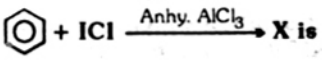
82. Hydrogen can be prepared by the action of dil H_2SO_4 on
(1) copper (2) iron
(3) lead (4) mercury

83. Supercritical CO_2 is used as
(1) dry ice (2) fire fighting
(3) a solvent for extraction of organic compounds from natural sources
(4) a highly inert medium for carrying out various reactions

84. The standard emf of a galvanic cell involving cell reaction with n = 2 found to be 0.295 V at 25°C . The equilibrium constant of the reaction would be
(1) 2×10^{11} (2) 4×10^{12}
(3) 1×10^{2} (4) 1×10^{10}

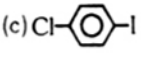
85. The type of isomerism observed in urea molecule is
(1) chain (2) position
(3) geometrical (4) tautomerism

86. The compound X in the reaction,



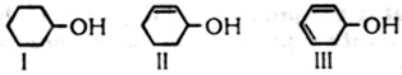
(a) 

(b) 

(c) 

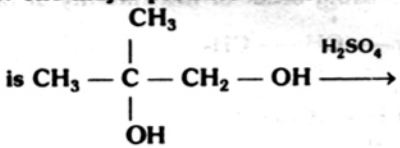
(d) 

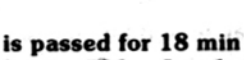
87. The correct order of ease of dehydration of following is



(1) I > II >III (2) III > II >I
(3) I > III >II (4) III > I > II

88. The major product of the following reaction



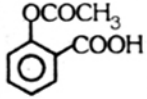
(1) $(CH_3)_2C = CH_2$
(2) butan-2-one
(3) 

(4) isobutyraldehyde

89. Methyl acetate and ethyl acetate can be distinguished by
(1) hot alkaline $KMnO_4$
(2) neutral $FeCl_3$ (3) iodoform test
(4) none of the above

90. An aliphatic amine on treatment with alcoholic carbon disulphide and mercuric chloride forms ethyl isothiocyanate, the reaction is known as
(1) Hofmann's reaction
(2) Hofmann's rearrangement
(3) Hofmann's mustard oil reaction
(4) Hofmann's bromamide degradation reaction

91. Protein can be denatured by
(1) carbon dioxide (2) carbon monoxide
(3) heat (4) oxygen

92. The compound 

is used as
(1) antiseptic (2) antibiotic
(3) analgesic (4) pesticides

93. With $K_4[Fe(CN)_6]$, Cu^{2+} ions gives
(1) a blue ppt.
(2) a bluish green ppt
(3) a blood red ppt .
(4) a reddish brown ppt .

94. When electric discharge is passed through neon at low pressure, the colour of the glow is
(1) red (2) green
(3) yellow (4) orange

95. According to the adsorption theory of catalysis, the speed of the reaction increases because

(1) adsorption produces heat which increases the speed of the reaction

(2) adsorption lowers the activation energy of the reaction

(3) the concentration of reactant molecules at the active centres of the catalyst becomes high due to adsorption

(4) in the process of adsorption, the activation energy of the molecules become large

96. At the high pressure, Langmuir adsorption isotherm takes the form

(1) $\frac{x}{m} = \frac{aP}{1 + bP}$ (2) $\frac{x}{m} = \frac{a}{b}$

(3) $\frac{x}{m} = aP$ (4) $\frac{m}{x} = \frac{b}{a} + \frac{1}{aP}$

97. A solution containing 10g per dm^3 of urea (molecular mass = 60gmol^{-1}) is isotonic with a 5% solution of a non volatile solute. The molecular mass of this non volatile solute is

(1) 300 g mol^{-1} (2) 350 g mol^{-1}

(3) 200 g mol^{-1} (4) 250 g mol^{-1}

98. Ethylene oxide when treated with Grignard reagent yield

(1) secondary alcohol

(2) tertiary alcohol

(3) cyclopropyl alcohol

(4) primary alcohol

99. The "saponification value" of an oil or fat is measured in term of

(1) NH_4OH (2) NaOH

(3) KOH (4) C_6H_5OH

100. Rayon is

(1) natural silk (2) artificial silk

(3) natural plastic or rubber

(4) synthetic plastic

§ ***Directions for Q. 101 -120 : In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as :***

(1) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(2) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion .

(3) If Assertion is true but Reason is false.

(4) If both Assertion and Reason are false.

101 . Assertion : H — S — H bond angle in H_2S is closer to 90° but H — O — H bond angle in H_2O is 104.5°

Reason : *l*p – *l*p repulsion is stronger in H_2S than in H_2O

102 . Assertion : Average life of a radioactive element is that period in which 63% of it is decayed.

Reason : Average life $\tau = 1.44 t_{1/2}$

103 . Assertion : At high pressure, the compression factor Z is $\left(1 + \frac{Pb}{RT}\right)$

Reason : At high pressure van der Waals' equation is modified as P(V – b) = RT.

104 . Assertion : Viscosity of a liquid decreases on increasing the temperature .

Reason : Evaporation of liquid increases with rise in temperature.

105 . Assertion : On mixing 500 mL of $10^{-6}MCa^{2+}$ ion and 500 mL of $10^{-6}MF^{-1}$ ion, the precipitate oi CaF_2 will be obtained.$K_{sp}(CaF_2 = 10^{-18})$

Reason : It K_{sp} is greater than ionic product, a precipitate will develop.

106 . Assertion : The conversion of fresh precipitate to colloidal state is called peptization.

Reason : It is caused by addition of common ions .

107 . Assertion : For the combustion of methane,

$\Delta E > \Delta H$

Reason : ΔH is related by ΔE by the expression .

$\Delta H = \Delta E + \Delta nRT$

108 . Assertion : According to Kohlrausch law the molar conductivity of a strong electrolyte at infinite dilution is sum of molar conductivities of its ions.

Reason : The current carried by cation and anion is always equal .

109 . Assertion : C — H bond in ethyne is shorter than C — H bonds in ethene.

Reason : Carbon atom in ethene is *sp* hybridised while it is sp^2 in ethyne.

110 . Assertion : Mercury vapour is shining silvery in appearance.

Reason : Mercury is a metal with shining silvery appearance.

111 . Assertion : H_3PO_3 is a dibasic acid .

Reason : There are two H atoms directly attached to P.

112 . Assertion : F — F bond in F_2 molecule is strong

Reason : F atom is small in size

113 . Assertion : In the electrolysis of aqueous NaCl, Na is preferentially discharged at mercury cathode forming sodium amalgam.

Reason : It is due to the fact that hydrogen has a high over voltage at mercury cathode.

114 . Assertion : Cu^{2+} and Cd^{2+} are separated by first adding KCN solution and then passing H_2S gas.

Reason : KCN reduces Cu^{2+} to Cu^{+} and form a complex with it.

115 . Assertion : Amines are more basic than esters and ethers.

Reason : Nitrogen is less electronegative than oxygen. It is in better position to accommodate the positive charge on the proton .

116 . Assertion : Alcohols have higher boiling points than ethers of comparable molecular masses.

Reason : Alcohols and ethers are isomeric in nature .

117 . Assertion : During test for nitrogen with Lassaigne extract on adding $FeCl_3$ solution sometimes a red precipitate is obtained .

Reason : Sulphur is also present.

118 . Assertion : NaCl is precipitated when HCl gas is passed in a saturated solution of NaCl .

Reason : HCl is strong acid.

119 . Assertion : Chlorine has higher electron affinity than fluorine .

Reason : Chlorine is a poor oxidising agent than fluorine.

120 . Assertion : The hydrolysis of methyl acetate by dil. HCl is a pseudo first order reaction .

Reason : HCl acts as a catalyst for the hydrolysis .

BIOLOGY

121. An artificial pace-maker is implanted subcutaneously and connected to the heart in patients

(1) having 90% blockage of the three main coronary arteries

(2) having a very high blood pressure

(3) with irregularity in the heart rhythm

(4) suffering from arteriosclerosis

122. *E.coli* about to replicate was placed in a medium containing radioactive thynidine for five minutes. Then it was made to replicate in a normal medium. Which of the following observation will be correct?

(1) Both the strands of DNA will be radioactive

(2) One strand radioactive

(3) Each strand half radioactive

(4) None is radioactive

123. Plasmids are suitable vectors for gene cloning because

(1) these are small circular DNA molecules which can integrate with host chromosomal DNA

(2) these are small circular DNA molecules with their own replication origin site

(3) these can shuttle between prokaryotic and eukaryotic cells

(4) these often carry antibiotic resistance genes

124. In a given plant, red colour (R) of fruits is dominant over white fruit (r) : and tallness (T) is dominant over dwarfness (t). If a plant with genotype RRTt is crossed with a plant of genotype rrtt. What will be the percentage of tall plants with red fruits in the next generation?

(1) 100% (2) 25%

(3) 50% (4) 75%

125. An action potential in the nerve fibre is produced when positive and negative charges on the outside and the inside of the axon membrane are reversed, because

(1) more potassium ions enter the axon as compared to sodium ions leaving it

(2) more sodium ions enter the axon as compared to potassium ions leaving it

(3) all potassium ions leave the axon

(4) all sodium ions enter the axon

126. Patients suffering from cholera are given a saline drip because

(1) Na^{+} ions help in stopping nerve impulses and hence, sensation of pain

(2) Na^{+} ions help in the retention of water in the body tissues

(3) NaCl is an important component of energy supply

(4) NaCl furnishes most of the fuel required for cellular activity

127. Choose the correct sequence of stages of growth curve for bacteria

(1) lag, log, stationary, decline phase

(2) lag, log, stationary phase

(3) stationary, lag, log, decline phase

(4) decline, lag, log phase

128. Which of the following statement is true?

(1) Vessels are multicellular and with wide lumen
(2) Tracheids are multicellular and with narrow lumen
(3) Vessels are unicellular and with narrow lumen
(4) Tracheids are unicellular and with wide lumen

129. During translation initiation in prokaryotes, a GTP molecule is needed in
(1) association of 30S, mRNA with formyl-met-*t*RNA
(2) association of 50S subunit of ribosome with initiation complex
(3) formation of formyl-met-*t*RNA
(4) binding of 30 subunit of ribosome with *m*RNA

130. Down's syndrome is caused by an extra copy of chromosome number 21. What percentage of offspring produced by an affected mother and a normal father would be affected by this disorder?
(1) 50% (2) 25%
(3)100 (4) 75%

131. *Nicotiana sylvestris* flowers only during long days and N. tobacum flowers only during short days. If raised in the laboratory under different photoperiods, they can be induced to flower at the same time and can be cross fertilized to produce self-fertile offspring . What is the best reason for considering N. sylvestris and N. tobacum to be separate species?
(1) They are physiologically distinct
(2) They are morphologically distinct
(3) They cannot interbreed in nature
(4) They are reproductively distinct

132. What is a keystone species?
(1) A species which makes up only a small proportion of the total biomass of a community, yet has a huge impact on the community's organization and survival
(2) A common species that has plenty of biomass, yet has a fairly low impact on the community's organization
(3) A rare species that has minimal impact on the biomass and on other species in the community
(4) A dominant species that constitutes a large proportion of the biomass and which affect many other species

133. Age of fossils in the past was generally determined by radio-carbon method and other methods involving radioactive elements found in the rocks. More precise methods, which were used recently and led to the revision of the evolutionary period for different groups of organisms, includes
(1) study of carbohydrates / proteins in fossils
(2) study of the conditions of fossilization
(3) Electron Spin Resonance (ESR) and fossil DNA
(4) study of carbohydrates / proteins in rocks

134. The telomeres of eukaryotic chromosomes consists of short sequences of
(1) thymine rich repeats
(2) cytosine rich repeats
(3) adenine rich repeats
(4) guanine rich repeats

135. Damage to thymus in a child may lead to
(1) a reduction in haemoglobin content of blood
(2) a reduction in stem cell production
(3) loss of antibody mediated immunity
(4) loss of cell mediated immunity

136. Auxospores and hormocysts are formed, respectively, by
(1) several diatoms and a few cyanobacteria
(2) several cyanobacteria and several diatoms
(3) some diatoms and several cyanobacteria
(4) some cyanobacteria and many diatoms

137. Photosynthetic Active Radiation (PAR) has the following range of wavelengths
(1) 400 - 700 nm (2) 450 - 950 nm
(3) 340 - 450 nm (4) 500 - 600 nm

138. Farmers in a particular region were concerned that pre-mature yellowing of leaves of a pulse crop might cause decrease in the yield. Which treatment could be most beneficial to obtain maximum seed yield?
(1) Frequent irrigation of the crop
(2) Treatment of the plants with cytokinins alongwith a small dose of nitrogenous fertilizer
(3) Removal of all yellow leaves and spraying the remaining green leaves with 2, 4, 5 - trichlorophenoxy acetic acid
(4) Application of iron and magnesium to promote synthesis of chlorophyll

139. In maize, hybrid vigour is exploited by
(1) bombarding the seeds with DNA
(2) crossing of two inbred parental lines
(3) harvesting seeds from the most productive plants
(4) inducing mutations

140. Match the following

A. *t*RNA	1.Linking of amino acids .
B. *m*RNA	2. Transfer of genetic information .
C. *r*RNA	3. Nucleolar organising region
D. Peptidyl transferase	4. Transfer of amino acid from cytoplasm of ribosome

Codes

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

141. Hybridomas are the fusion product of

(1) normal antibody producing cell within myeloma

(2) abnormal antibody producing cell with myeloma

(3) sex cells with myeloma

(4) bone cells with myeloma

142. Match the following ovular structure with post fertilization structure and select the correct alternative

A.	Ovule	1. Endosperm
B.	Funiculus	2. Aril
C.	Nucellus	3. Seed
D	Polar nuclei	4. Perisperm

Codes

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

143. Arrange the following in the order of increasing volume

(1) Tidal volume

(2) Residual volume

(3) Expiratory reserve volume

(4) Vital capacity

(1) 1< 2 < 3 < 4 (2) 1 < 3 < 2 < 4

(3) 1 < 4 < 3 < 2 (4) 1 < 4 < 2 < 3

144. On the basis of symptoms of chlorosis in leaves a student inferred that this was due to deficiency of nitrogen. The inference could be correct only if we assume that yellowing of leaves appeared first in

(1) old leaves

(2) young leaves

(3) young leaves followed by mature leaves

(4) mature leaves followed by young leaves

145. What is common among silver fish,scorpion crab and honey bee?

(1) Compound eyes

(2) Poison glands

(3) Jointed appendages

(4) Metamorphosis

146. Diphtheria is caused by

(1) poisons released by living bacterial cells into the host tissue

(2) poisons released from dead bacterial cells into the host tissue

(3) poisons released by virus into the host tissues

(4) excessive immune response by the host's body

147. In the developmental history of mammalian heart, it is observed that it passes through a two - chambered fish-like heart, three chambered frog-like heart and finally four chambered stage. To which hypothesis can this above cited statement by approximated?

(1) Biogenetic law (2) Hardy Weinberg law

(3) Lamarck's principle (4) Mendelian principles

148. A sewage treatment process in which a portion of the decomposer bacteria present in the waste is recycled into the beginning of the process, is called

(1) cyclic treatment

(2) primary treatment

(3) activated sludge treatment

(4) tertiary treatment

149. Cellulose, the most important constituent of plant cell wall is made up of

(1) branched chain of glucose molecules linked by α, 1, 6 glycosidic bond at the site of branching

(2) unbranched chain of glucose molecules linked by α, 1, 4, glycosidic bond

(3) branched chain of glucose molecules linked by β, 1, 4 glycosidic bond in straight chain and α, 1, 6 glycosidic bond at the site of branching

(4) unbranched chain of glucose molecules linked by β, 1, 4 glycosidic bond

150. Which one of the following is a matching pair of a certain body feature and its value / count in a normal human adult?

(1) Urea 5-10 mg / 100 mL of blood.

(2) Blood sugar (fasting) -70-100 mg / 100 mL

(3) Total blood volume -5-6

(4) ESR in Wintrobe method- 9-15 mm in males and 20-34 mm in females

151. Continued consumption of a diet rich in butter, red meat and eggs for a long period may lead to

(1) vitamin A toxicity

(2) kidney stones (3) hypercholesterolemia

(4) urine laden with ketone bodies

152. Which of the following pairs is correctly matched?

(1) Rhizobium – Parasite in the roots of leguminous plants

(2) Mycorrhizae – Mineral uptake from soil
(3) Yeast – Production of biogas
(4) Myxomycetes – The disease ringworm

153. Which one of the following is correctly matched regarding an Institute and its location?
(1) National Institute of Virology – Pune
(2) National Institute of Communicable Disease – Lucknow
(3) Central Drug Research Institute – Kasauli
(4) National Institute of Nutrition – Mumbai

154. A lake with an inflow of domestic sewage rich in organic waste may result in
(1) drying of the lake very soon due to algal bloom
(2) an increased production of fish due to lot of nutrients
(3) death of fish due to lack of oxygen
(4) increased population of aquatic food web organisms

155. Women who consumed the drug thalidomide for relief from vomiting during early months of pregnancy gave birth to children with
(1) no spleen (2) hare - lip
(3) extra fingers and toes
(4) under developed limbs

156. Which one of the following four glands is correctly matched with the accompanying description?

(1) Thyroid	Hyperactivity in young children causes cretinism
(2) Thymus	Starts undergoing atrophy after puberty
(3) Parathyroid	Secretes parathormone which promotes movement of calcium ions from blood into bones during calcification
(4) Pancreas	Delta cells of the Islets of Langerhans secrete a hormone which stimulates glycolysis in liver

157. Formation of non - functional methaemoglobin causes blue - baby syndrome. This is due to
(1) excess of arsenic concentration in drinking water
(2) excess of nitrates in drinking water
(3) deficiency of iron in food
(4) increased methane content in the atmosphere

158. Grain colour in wheat is determined by three pairs of polygene. Following the cross AABBCC. (dark colour) × aabbcc (light colour), in F_2 generation what proportion of the progeny is likely to resemble either parent?
(1) Half (2) Less than 5 percent
(3) One third (4) None of the above

159. What would happen if in a gene encoding a polypeptide of 50 amino acids will be (UAC) mutated to UAA ?
(1) A polypeptide of 49 amino acids will be formed
(2) A polypeptide of 25 amino acids will be formed
(3) A polypeptide of 24 amino acids will be formed
(4) Two polypeptides of 24 and 25 amino acids will be formed

160. Drosophila flies with XXY genotype are females, but human beings with such genotype are abnormal males. It shows that
(1) Y - chromosome is essential for sex determination in Drosophila
(2) Y - chromosome is female determinating in Drosophila
(3) Y - chromosome is female determinating in human beings
(4) Y - chromosome has no role in sex determination either in Drosophila or in human beings

§ ***Direction for Q. 161 to Q 180 : In each of the following questions a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statement, mark the correct answer as :***

(1) If both Assertion and Reason are true and Reason is the correct explanation of the Assertion
(2) If both Assertion and Reason are true but the Reason is not the correct explanations of Assertion.
(3) If Assertion is true, but Reason is false .
(4) If both Assertion and Reason are false.

161 . *Assertion* : Euglena is a plant due to presence of chlorophyll .
Reason : Euglena can not be classified on the basis of two kingdom system

162 *Assertion* : In fungi sexual apparatus decrease in complexity from lower to higher forms
Reason : In algae sexual apparatus increases in complexity from simple to the higher forms

163 . *Assertion* : The true nucleus is generally absent in *E. coli* and other prokaryotes

***Reason* :** An undifferentiated, unorganised fibrillar nucleus without any limiting membrane is observed in prokaryotic cells

164 . *Assertion* : The imbalance in concentration of Na^+, K^+ and proteins generates resting potential

***Reason* :** To maintain the unequal distribution of Na^+ and K^+, the neurons use electrical energy.

165 *Assertion* : Arachidic acid is an unsaturated fatty acid .

***Reason* :** There are present one or more double bonds between carbon atoms in unsaturated fatty acids .

166 *Assertion* : A coenzyme or metal ion that is very tightly bound to enzyme protein is called prosthetic group .

***Reason* :** A complete, catalytically active enzyme together with its bound prosthetic group is called apoenzyme.

167 . *Assertion* : Amber codon is a termination codon.

***Reason* :** If in a mRNA, a termination codon is present, the protein synthesis stops abruptly whether the protein synthesis is complete or not .

168 . *Assertion* : In cymose tap root system, oldest branch lies very near the growing point, of the root while the youngest branch is farthest away from it .

***Reason* :** In cymose tap root system, the primary root itself stops growing after sometime; but secondary roots carry on further growth of the root system.

169 . *Assertion* : 7 - celled, 8 nucleate and monosporic embryosac is called *Polygonum* type of embryo sac .

***Reason* :** It was discovered by Hofmeister for the first time in *Polygonum*.

170 *Assertion* : The quiescent centre acts as a reservoir of relatively resistant cells which constitute a permanent source of active initials

***Reason* :** The cells of the inactive region of quiescent centre become active when the previous active initials get damaged.

171 *Assertion* : Phase of cell division is also known as formative phase

***Reason* :** In formative phase new cells are produced from pre-existing cells through meiosis division .

172 . *Assertion* : Nitrogen fixing enzyme in legume root nodules functions at low oxygen concentration.

***Reason* :** Low oxygen concentration is provided by leghaemoglobin .

173 . *Assertion* : When dried seeds of pea are placed in a tin and water added up to their upper level and then a lid is putted lightly over it. Within an hour, the lid will be blown off.

***Reason* :** Due to rapid cell division in pea seeds.

174 *Assertion* : Cyclic pathway of photosynthesis first appeared in some eubacterial species .

***Reason* :** Oxygen started accumulating in the atmosphere after the non cyclic pathway of photosynthesis evolved.

175 *Assertion* : Organochlorine pesticides are organic compounds that have been chlorinated.

***Reason* :** Fenitrothion is one of the organochlorine pesticides.

176 . *Assertion* : Tropical rain forests are disappearing fast from developing countries such as India .

***Reason* :** No value is attached to these forests because these are poor in biodiversity .

177 *Assertion* : Gene flow increase genetic variations.

***Reason* :** The random introduction of new alleles into recipient population and their removal from the donor population affects allele frequency .

178 . *Assertion* : Mast cells in the human body release excessive amount of inflammatory chemicals which cause allergic reactions .

***Reason* :** Allergens in the environment on reacting human body stimulate mast cells in certain individuals.

179 . *Assertion* : Thick layers of muscles are present in the wall of alimentary canal.

***Reason* :** These muscles help in the mixing of food materials with the enzymes coming from different glands in the alimentary canal.

180 . *Assertion* : Phenylketonuria is a recessive hereditary disease caused by body's failure to oxidise an amino acid phenylalanine to tyrosine, because of defective enzyme.

***Reason* :** It results the presence of phenylalanine acid in urine .

General Knowledge

181. Which mirror is used as a rear view mirror in vehicles ?
(1) plain (2) convex
(3) concave (4) spherical

182. The compilation "Meri Ekyawan Kavitayen' is by
(1) A.B. Vajpayee
(2) Harivanshrai Bachchan
(3) Dharam Vir Bharti
(4) Shiv Mangal Singh Suman

183. 'Equinox' means
(1) days are longer than nights
(2) days and nights are equal
(3) days are shorter than nights
(4) none of these

184. Who was known as "Nightingale of India"?
(1) Vijaylaxmi Pandit (2) Sarojini Naidu
(3) Suraiya (4) None of these

185. Gaya is associated with Lord buddha, where he
(1) was born
(2) attained enlightenment
(3) died
(4) delivered his first sermon

186. Chemical change does not take place in
(1) souring of milk into curd
(2) rusting of iron in atmosphere
(3) burning of magnesium ribbon in air
(4) emitting of light by a red hot platinum wire

187. Who is the highest wicket taker in Indian Cricket team ?
(1) Javagal Srinath (2) Anil Kumble
(3) Maninder Singh (4) Kapil Dev

188. Which country leads in production of aluminium and goods ?
(1) Australia (2) U.S.
(3) Russia (4) Japan

189. Which of the following places was known as a centre of learning India ?
(1) Nalanda (2) Ujjain
(3) Allahabad (4) none of these

190. The process of transfer of heat by matter but without actual movement of the particles themselves is called
(1) conduction (2) convection
(3) radiation (4) none of these

191. Only zero and one are used for operating
(1) Calculator (2) Computer
(3) Abacus (4) Type writer

192. Transistor is
(1) semi conductor (2) inductor
(3) modulator (4) demodulator

193. Computer cannot
(1) send massage (2) read files
(3) abstract thought (4) play music

194. Which of the following is not a carbohydrate ?
(1) wax (2) starch
(3) sucrose (4) maltose

195. Which of the following is an eye disease ?
(1) hepatitis (2) measles
(3) glaucoma (4) bronchitis

196. Which of the following is the vaccine for tuberculosis ?
(1) OPT (2) BCG
(3) salk vaccine (4) rubella vaccine

197. Horns, nails and hair are
(1) soluble fats
(2) insoluble carbohydrates
(3) keratin proteins
(4) complex lipids

198. Who conducts the State assembly elections ?
(1) Chief Justice of the High Court concerned
(2) Chief Justice of the Supreme Court
(3) Chief Election Commissioner
(4) Governor of the state concerned

199. Which is an ore of aluminium ?
(1) chromite (2) cuprite
(3) bauxite (4) siderite

200. Kalidas was
(1) A poet during the Gupta period
(2) A dramatist during Harshvardhana's reign
(3) An astronomer during Gupta period
(4) None of these

Answers With Explanations

1. (1) From thermol effect,

$$T_i - T_n = T_n - T .$$

Where T_i = temp. of. inversion .

T_n = Neutral temp .

T = temp . of cold junction

$$\Rightarrow \quad 2T_n = T_i - T.$$

But $T = 0$,

$$\therefore \quad T_n = \frac{T_i}{2}$$

2. (2) In β – decay,

$${}_0n^1 \longrightarrow {}_1p^1 + \beta + \bar{\nu} .$$

So, the neutron given β - particle

3. (3) According to question

$$\tan\theta = \frac{3}{\sqrt{3}} = \sqrt{3} = \tan 60^\circ$$

$$\therefore \quad \theta = 60^\circ$$

4. (2) The shunt resistance

$$S = \frac{i \times R}{i - i_a}$$

where i = total current

i_a = ammeter current

$$\Rightarrow \quad S = \frac{100 \times 13}{750 - 100}$$

$$= \frac{1300}{650}$$

$$= 2\Omega .$$

5. (2) $\phi = \phi + 4t$

$$\therefore \quad Vp = \frac{d\phi}{dt} = 4 .$$

Again, $n_p = 50, n_s = 1500$

and $$\frac{Vs}{Vp} = \frac{n_s}{n_p}$$

$$\therefore \quad Vs = Vp \times \frac{n_s}{n_p}$$

$$= 4 \times \left(\frac{1500}{50}\right)$$

$$= 120$$

6. (3) Since $Y = a .\sin\omega$

at $Y = a/2$

$$\frac{a}{2} = a.\sin\omega t$$

$$\Rightarrow \quad \sin\omega t = \frac{1}{2} = \frac{\pi}{6}$$

$$\therefore \quad t - \frac{\pi}{6\omega} = \frac{T}{12}$$

7. (1) In this diagram, the conduction band came near the valence band.

8. (4) Since, $N = N_o.e^{-\lambda t}$

$$\therefore \quad N_1 = N_o e^{-5\lambda t}$$

and $$N_2 = N_o e^{-\lambda t}$$

$$\therefore \quad \frac{N_1}{N_2} = \frac{e^{-5\lambda t}}{e^{-\lambda t}} = e^{-4\lambda t}$$

$$\Rightarrow \quad \frac{N_1}{N_2} = \left(\frac{1}{e^{4\lambda t}}\right)$$

A. T . Q :

$$\frac{N_1}{N_2} = \frac{1}{e^2}$$

$$\therefore \quad \frac{1}{e^{4\lambda t}} = \frac{1}{e^2}$$

$$\therefore \quad 4\lambda t = 2$$

$$\Rightarrow \quad t = \frac{2}{4\lambda} = \frac{1}{2\lambda}$$

9. (1) Since $I = \frac{q}{t} = q \times \frac{\omega}{2\pi}$.

and $$\omega = \frac{V}{R}$$

$$\therefore \quad I = \frac{qv}{2\pi R.}$$

$\therefore$ magnetic moment

$$= \mu = I.A$$

$$= \frac{qv}{2\pi R} \times \pi R^2$$

$$= \frac{1}{2} qvR .$$

10. (2) Since $L = mvr$.

So, for the same distance,

$$L_A = L_B .$$

11. (2) Since $F = k.a$

A .T .Q :- $F = ma$

$$\therefore \quad ka = mg$$

$$\Rightarrow \quad a = \frac{mg}{k} = \frac{2 \times 10}{200}$$

$$= 10cm .$$

12. (2) In magnetic field only the particle moves in circular path .

13. (3) A . C. power $= \frac{\Delta V_c}{\Delta V_i} \times \frac{\Delta i_c}{\Delta i_b}$

$= \frac{\Delta V_c}{\Delta V_i} \times \frac{\Delta i_c}{\Delta i_b}$

$= A_V \times \beta_{AC}$

$\therefore \quad A_V = \beta_{AC} \times$ resistance gain

$\therefore \quad \beta_{AC} = \frac{A_V}{r} = \frac{50 \times 100}{200}$

$= 25$.

14. (1) The instantaneous velocity and acceleration of a particle executing S . H . M is 90°

15. (4) Since $R = \frac{V}{i} = \frac{W}{qi}$

$= \frac{ML^2T^{-2}}{[IT].[I]}$

$= ML^2T^{-3}.I^{-2}$

16. (3) $C = \frac{\theta}{l.\alpha} =$

where, θ = angle of rotation

α = specific rotation

$\therefore \quad C = \frac{0.4}{0.25 \times 0.01} = 160$ kg/m^3

$\therefore$ purity of sugar solution

$= \frac{160}{200} \times 100 = 80\%$

17. (3) Air resistance for streamlined surface is minimum. and maximum resistance for maximum surface.

18. (1) Since

$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$

$= \frac{1}{\infty} + \frac{1}{f}$

$= \frac{1}{f}$

$\therefore \quad F = f.$

Again, $\frac{1}{F} = \frac{1}{f'_1} + \frac{1}{f'_2}$

$= \frac{1}{f} - \frac{1}{f}$

$\therefore \quad F' = \infty$

19. (3)

20. (3) The gas behaves ideally. There is no deviation in the value of $\frac{pV}{nT}$ for different temperatures T_1 and T_2 for increasing pressure is represented by dotted line. Hence, dotted line corresponds to 'ideal' gas behaviour.

(ii) Higher the temperature lesser is deviation of gas. Deviation of T_2 > Deviation of T_1

Hence, $T_1 > T_2$

(iii) Since the point of intersection lies on dotted line, the value of $\frac{pV}{nT}$ at that point on the y-axis is same for all gases.

21. (2) Since, $n = \frac{\sin i}{\sin r} = \frac{\theta}{r}$. (For small angles)

$\therefore \quad d = t\left(\theta - \frac{\theta}{n}\right)$

$= t\theta\left(1 - \frac{1}{n}\right)$

$= \frac{t\theta(n-1)}{n}$

22. (3) From law of conservation of energy .

K.E + P.E = const

$\frac{1}{2}mV_i^2 - \frac{GM_E.m}{10.R} = \frac{1}{2}mV_f^2 - \frac{G.M_Em}{R}$

$\Rightarrow \frac{1}{2}mV_f^2 = \frac{1}{2}mV_i^2 + \frac{G.M_Em}{R} - \frac{G.M_Em}{10R}$

$\Rightarrow V_f^2 = V_i^2 + \frac{2G.M_E}{R_E} - \frac{2G.M_E}{10R}$

$= V_i^2 + \frac{2G.M_E}{R_E}\left(1 - \frac{1}{10}\right)$

23. (2) According to Fleming's left hand rule .

24. (4) **25.** (1)

26. (1)

27. (1) From conservation of energy

$mgh = \frac{1}{2}mv^2 + mgh_2$

$\Rightarrow \quad mg(h - h_2) = \frac{1}{2}mv^2$

$\therefore \quad v = \sqrt{2g(100-20)}$

$= \sqrt{2 \times 10 \times 80}$

$= 40$ m/sec.

28 (1) This figure is not exact but it is correct .

29. (4) Since $\beta = a \log\left(\frac{I}{I_o}\right)$

$\therefore \quad \beta_1 = 10\log\left(\frac{I}{I_o}\right)$

and $\beta_2 = 10 \log\left(\frac{I'}{I_o}\right)$

$\therefore \quad \beta_2 - \beta_1 = 20$

$\therefore \quad 20 = 10.\log\left(\frac{I'}{I}\right)$

$\Rightarrow \quad I' = 100\, I.$

30. (1) Here all the plates except last one is taking part in formation of capacitor so, these capacitors are in parallel and n plates forms (n – 1) no. of capacitors.

So, the equivalent capacitance

$= (n-1).C.$

31 (2) Since $I = I_o.\cos^2\theta$

$\therefore$ The graph for intensity and angle is of type (2) .

32 (1) Time constant of RC circuit

$= \tau = RC = 10^4 \times 10^{-10}$

$= 10^{-6}$sec. .

For demodulation

$\Rightarrow \quad f_c >> \frac{1}{RC.}$

$\Rightarrow \quad f_c >> 10^6$Hz

$\Rightarrow \quad f_c >> 1$MHz

33. (2) $V = \frac{\text{Volt}}{\text{emf}} \times \text{rpm}$

$= \frac{120}{100} \times 1500$

$= 1800$rpm.

34. (3) No. of photons reaching

$= n = \frac{\text{Energy Received from sun ,}}{\text{Energy of one photon}}$

$= \frac{E}{hc/\lambda}$

$= \frac{E \times \lambda}{hc}$

$= \frac{8.4 \times 5500 \times 10^{-10}}{6.6 \times 10^{-34} \times 3 \times 10^8}$

$= 2.3 \times 10^{19}$

35. (1) Binding Energy $= \frac{hc}{\lambda} - E$

Since energy of incident photon

$= E = \frac{hc}{\lambda} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{4.9 \times 10^{-10}}$

$= 2.54$ kev.

Now for cloud chamber, the energy is

$E = \frac{R_2}{\alpha} = \frac{2.02}{1} = 2.02$kev

$\therefore$ Binding Energy $= 2.54 - 2.02$

$= 0.52$kev

36. (1) Since $\lambda_{min.} = \frac{hc}{b}$

$= \frac{4.14 \times 10^{-15} \times 3 \times 10^8}{35 \times 10^3}$

$= 3.55 \times 10^{-11}$m.

$= 35.5$pm.

37. (2) Change in temp .

$\Delta T = \frac{Q/m}{s}$

where S = specific heat .

$\therefore \quad \Delta T = \frac{3}{4180} = 7.2 \times 10^{-4}$k

$= 700\mu$k.

38. (4) The no . of argon atom present

$N_{Ar} = N_o - N$

$= N_o - N_o.e^{-\lambda t}$

$N_o e^{-\lambda t} = N_o - N_{Ar}$

$\Rightarrow \quad e^{-\lambda t} = \left(1 - \frac{N_{Ar}}{N_o}\right)$

Taking log on both the sides, we get

$-\lambda t = \ln\left(1 - \frac{N_{Ar}}{N_o}\right)$

$\Rightarrow \quad \lambda t = \ln\left(1 + \frac{N_{Ar}}{N_o}\right)$

$\therefore \quad t = \frac{\ln\left(1 + \frac{N_{Ar}}{N_o}\right)}{\lambda}$

$= \frac{T_{1/2} \ln\left(1 + N_{Ar}/N_o\right)}{\ln 2}$

$= \frac{\left(1.25 \times 10^9\right) \times [\ln(1 + 10.3)]}{\ln 2}$

$= 4.37 \times 10^9$years.

39. (1) Here the positive velocity represents upward motion and negative velocity represents downward motion .

40. (1) Since $v \propto [\sigma^-]^a [\rho]^b [\lambda]^c$.

$\Rightarrow \quad ML^1T^{-1} = k\left[MT^{-2}\right]^a \left[ML^{-3}\right]^b [L]^c$

$= k.[M]^{a+b}[L]^{-3b+c}[T]^{-2a}$

Equating the power on both the sides, we get

$a + b = 0.$

$-3b + c = 1$

$-2a = -1$

$\therefore \quad a = \frac{1}{2},$

$b = -\frac{1}{2},$

$c = -\frac{1}{2},$

$\therefore \quad v \propto \sigma^{1/2}.\rho^{-1/2}.\lambda^{-1/2}.$

$\Rightarrow \quad v^2 \propto \frac{\sigma}{\rho\lambda}.$

41. (1) When a person is high up on the ladder, then a large torque is produced due to his weight about the point of contact between the ladder and the floor. Whereas when he starts climbing up, the torque is small . Due to this reason the ladder is more apt to slip, when one is high up on it .

42 (4) The period of the liquid executing SHM in a U-tube does not depend upon the density of the liquid.

So, as the pendulum oscillates, its amplitude goes on decreasing .

43. (1) The average density of cargo vessels must be less than that of water so, the concrete cargo vessels did not sink .

44. (2) The antenna of portable AM radio is sensitive to only magnetic components of electromagnetic waves.

45. (1) The greenhouse effect is the rise in temperature that the Earth experiences because certain gases in the atmosphere (water vapor, carbon dioxide, nitrous oxide, and methane, for example) trap energy from the sun. Without these gases, heat would escape back into space and Earth's average temperature would be about 60°F colder. Because of how they warm our world, these gases are referred to as greenhouse gases.

46. (1) In LED (Light emitting diode) the energy is released at the junction due to the recombination of electron and holes in forward biased .

The LED is a specialised form of PN junction that uses a compound junction. The semiconductor material used for the junction must be a compound semiconductor. The commonly used semiconductor materials including silicon and germanium are simple elements and junction made from these materials do not emit light. Instead compound semiconductors including gallium arsenide, gallium phosphide and indium phosphide are compound semiconductors and junctions made from these materials do emit light.

47.(1) Optical communication is a system by which we transfer the informations over any distance from one location to other through optical range of frequency using optical fibre. The optical interference between fibres is zero. Hence, optical fibre communication has immunity to cross talk. Optical fibres are almost completely immune from external fields. They do not suffer from cross-talk, radio interference, etc.

48. (3) The term Albedo explains the reflecting power of planet to reflect the light which is incident on it. Albedo (Al-bee-dough): the fraction of the incident sunlight that is reflected. When an object reflects most of the light that hits it, it looks bright and it has a high albedo. When an object absorbs most of the light that hits it, it looks dark. Dark objects have low albedos. With the knowledge of Albedo we can confirm the presence of atmosphere clouds at the planet.

49. (2) The energy gap between valence band and conduction band in germanium is 0.76 eV and the energy gap between valence band and conduction band in silicon is 1.1 eV . Also it is true that thermal energy produces fewer minority carriers in silicon than in germanium.

50. (4) When some medium of refractive index μ and thickness 't' is placed between the path then the effective path of ray of light increases as $(\mu - 1)$.

But the zero fringe made by the two wave which shifts by the similar path. So, there is no shift in central fringe.

51. (4) From lens maker formula.

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right).$$

So for the biconvex lens the formula remains same.

52. (4) For inclined plane, the reactional force

$= R = mg\cos\theta.$

Again, the resultant force .

$f = F - \mu R$

$ma. = mg\sin\theta - \mu mg\cos\theta$

$= mg(\sin\theta - \mu\cos\theta)$

$\therefore \quad a = g.(\sin\theta - \mu\cos\theta)$

53. (2) There are two types of electron microscope :

(i) Transmission Electron Microscope (TEM) : It is used to study internal structure of the specimen . and gives two dimensional (2 D) view . The transmission electron microscope (TEM) operates on the same basic principles as the light microscope but

uses electrons instead of light. What you can see with a light microscope is limited by the wavelength of light. TEMs use electrons as "light source" and their much lower wavelength makes it possible to get a resolution a thousand times better than with a light microscope.

You can see objects to the order of a few angstrom (10-10 m). For example, you can study small details in the cell or different materials down to near atomic levels.

Transmission Electron Microscopy (TEM) does give high-resolution information of a sample, but the three-dimensional information is projected into a 2D image.

(ii) Scanning Electron Microscope (SEM) : it is for examining the surface of a specimen and gives three dimensional (3D) surface view . Scanning Electron Microscopy (SEM) can provide a high-resolution image of a surface in three dimensions (topography), but the material below the surface is not imaged.

54. (1) We know that to measure thermal conductivity of liquids experimentally, they must be heated from the top i.e. upper layer is kept hot and lower layer is kept cold, so as to prevent convection in liquids .

55. (4) According to second law of thermodynamics, there is a net transfer of heat from a body at lower temperature to a body at higher temperature without the aid of an external agent. Since the given information produces a contradiction in second law of thermodynamics, it is not possible to produce temperature of 8000 k by collecting the sun rays with a lens.

56. (2) From the Gay Lussac's law, $p \propto T$.

So, that when temperature increases the pressure also increase.

57. (1) Waves produced on the surface of water are transverse in nature. When such ways are produced in water they spread out. Till the ocean waves reach the beach-shore, they acquire such a large radius of curvature that they may be assumed as plane waves. Hence, ocean waves hit the beach normally to the shore.

58. (1) Due to induction the opposite charge develops at the sharp edge which ejects the charge and neutralizes the cloud. This sharp edge protects the buildings .

59. (1) We observe that both the magnets exert equal and opposite force/ torque on each other . Hence, net force/ torque on cork will be zero .

60. (3) According to principle of conservation of angular momentum. "in the absence of external torque, the total angular momentum L of the system remains conserved" i.e. $L = I\omega$ = constant (where I is moment of inertia & ω be the angular velocity). If one of the parameter (i.e. I or ω) increases then other decreases and vice-versa in order to conserve angular momentum. So, the angular velocity ω will remain constant as long as moment of inertia I remains constant from the principle of conservation of angular momentum. In the wohrlwind in a tornado, the air from nearby regions gets concentrated in a small space thereby decreasing the value of tis moment of inertia considerably and resulting in increase in angular speed.

When no external torque acts then $\tau = 0$.

$$\Rightarrow \quad \frac{dL}{dt} = 0 \quad \Rightarrow \quad L = \text{constant.}$$

61. (4) When C_2H_5OH reacts with chlorine it gives trichloro acetaldehyde (CCl_3CHO), it is also known as chloral . Chloral further in the presence of NaOH gives chloroform

$$CH_3CH_2OH + Cl_2 \xrightarrow{\text{Oxidation}} \underset{\text{Acetaldehyde}}{CH_3CHO} + 2HCl$$

$$CH_3CHO + 3Cl_2 \xrightarrow{\text{chlorination}} \underset{\text{chloral}}{CCl_3CHO} + 3HCl$$

$$CCl_3CHO + NaOH \xrightarrow{\text{Hydrolysis}} CHCl_3 + HCOONa .$$

Chloroform Sodium formate

62. (4) $CH_3 - \overset{+}{C}H - OCH_3$ is resonance stabilised as,

$$CH_3-\overset{+}{C}H-\ddot{O}-CH_3 \longleftrightarrow CH_3-CH=\overset{+}{\ddot{O}}-CH_3$$

Due to such resonance stability the formed carbocation is most stable among all the given carbocations .

$CH_3 - \overset{+}{C}H - CH_3$ is less stable than earlier but more stable than $CH_3 - CH - COCH_3$ it is due to the fact that in early case there is no electron withdrawing group hence more stable than the later because later contains $-\overset{O}{\overset{\|}{C}}-$ (carbonyl) group which is electron withdrawing in nature. The correct order of stability is II > I > III

63. (1) $CH_3 - \underset{|}{CH} - \overset{O}{\overset{\|}{C}} - CH_2 - CH_2OH$

1-hydroxy - 4 - methyl pentane - 3- one.

64. (1) PbO is commonly known as Litharge. PbO generally used in glass making (specially flint glass) .It is an amphoteric oxide which can react both with acid as well as alkali

65. (3) For the reaction

$$N_2O_5 \longrightarrow 2NO_2 + \frac{1}{2}O_2$$

$t_{1/2} = 2.4$ hr . ; Total No of half Life $= \frac{9.6}{2.4} = 4$

Since 10.8 g gives 0.8 g oxygen at 1st half life .

$$0.8 \text{ g of oxygen} = \frac{22.4}{40} \text{ Litre}$$

Total volume of oxygen obtained after 4 half life .

$$= \frac{22.4}{40} + \frac{22.4}{80} + \frac{22.4}{160} + \frac{22.4}{320}$$

$= 1.05$ Litre

66. (4) CO_3^{2-} ,BF_3 and $N(SiH_3)_3$ shows planar structure B in BF_3 and C in CO_3^{2-} are sp^2 hybridized hence shows planar geometry. N in $N(SiH_3)_3$ is sp^3 hybridised but due to steric effect of butyl (SiH_3) - group make the molecule planar in shape.

67. (3) Basic strength depends up on the availability of lone pair of electrons. The correct increasing order of basic strength is as follows

$H_2O < CH_3OH < OH^- < CH_3O^-$.

H–Ö–H has two lone pair 1 of electrons that is why it behaves as base, H–Ö–CH_3 has two lone pair of electrons with one electron pumping group, therefore, this compound is more basic than H_2O .

H–Ö: has one negative charge and two lone pair of electron that is why availability of lone pair is greater than early two cases hence, more basic than early two compounds.

$CH_3 \rightarrow$ Ö: has one negative charge, two lone pair of electrons and one electron pumping group. All these combination makes this species most basic among the given species compounds .

68. (2) For each central atom there are two tetrahedral voids in AgI crystal . The number of Ag^+ ion is equal to number of I^- ion. It means only 50% of the void will be occupied by Ag^+ ion

69. (3) Molecular mass $= \frac{RTd}{P}$

$$= \frac{0.0821 \times 273 \times 1.293}{1} ; (d = 1.293 \text{ g/L})$$

$= 28.98$ g/mol

Molecular mass $= 2 \times$ vapour density

vapour density $= \frac{28.98}{2} = 14.49$

70. (2) $As_2O_3 \rightleftharpoons 2As^{3+} + 3O^{2-}$

$Ksp = (2S)^2(3S)^3$

$10.8 \times 10^{-19} = 108\ S^3$

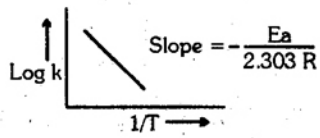
$S = 10^{-2}$.

Solubility will be 2×10^{-2} if dissociation is 50% .

71. (2) According to Arrhenius equation

$k = Ae^{-Ea/RT}$ (where E_a is energy of activation)

E_a can be calculated with the help of slope by plotting the curve between log k and $\frac{1}{T}$

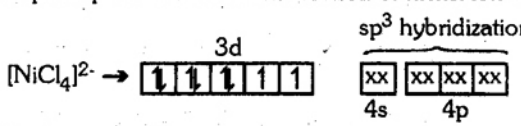


72. (2) Higher oxidation state of compound favours the covalent character. I_2O_9 and I_2O_7 does not exist therefore I_2O_5 is only oxide of iodine which is at its highest oxidation states .

73. (4) When H_2S gas is passed through the HCl containing aqueous solution of $CuCl_2$, $HgCl_2$, $BiCl_3$ and $COCl_2$ few compound precipitated out viz, CuS ,HgS and Bi_2S_3 but CoS will not be precipitated out by the same . It is due to the fact that the solubility product of sulphide of II nd group is lesser than the solubility product of sulphide of group IV, therefore, Cobalt sulphide will not be precipitated out.

74. (4) $_{28}Ni \Rightarrow 3d^8 4s^2$ configuration

For Ni^{2+} ion $\Rightarrow 3d^8 4s^0$ configuration .As we know chloride is weak Ligand, therefore, it is not capable to pair up the valence shell electron of nickel ion .



Since Cl^- ion, is unable to pairup the valence shell electron, therefore, the lone pair of electrons of Cl^- ion enters in to the outer orbital of Ni^{2+} ion viz, 4s and 4p . The structure of sp^3 hybrid orbital is tetrahedral .

75. (4) In general, a metal oxide with more ionic character will be more basic. Larger the size of cation greater be the ionic character. The correct order of ionic radii .

$$Ti^{2+} > V^{2+} > Cr^{2+} > Fe^{2+} .$$

Ionic character of oxide will follow the same trend as

$$TiO > VO > CrO > FeO .$$

76. (4) *Ortho*-and *para* - amino benzoic acid does not exist as zwitter ion . It is because lone pair of elec-

tron of $\ddot{N}H_2$ group delocalizes in resonance. –COOH group becomes less acidic because benzene ring after receiving lone pair of electron from– NH_2 group does not behave as electron withdrawing group . Due to non-availability of lone pair of electron on – NH_2 group and less acidic nature of –COOH group Zwitter formation is simply difficult .

77 . (1) Benzene ring is aromatic conjugated system in which the ring is resonance stabilized, hence, does not react with alkaline $KMnO_4$. It does not contain acidic hydrogen, therefore, it does not react with ammoniacal $AgNO_3$ solution .

78 . (3) Poly methyl methacrylate (PMMA) is used in making Light Weight Lenses and aircraft wind screen etc. Its trade name is Plexiglas.

79 . (3) $CH_3OH(c) + \frac{3}{2}O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$

$\Delta H = -723$ kJ

$\frac{3}{2}O_2$ combustion gives = –723 kJ .

IO_2 combustion gives = $\frac{-723 \times 2}{3} = -482$ kJ

80 . (1) The actual enthalpy of hydrogenation of C_6H_6

$\Delta Ha = [3 \times (-119.5)] - (-150.4)$

$= -208.1$ kJ/mol

81 . (2) No .of moles of $Ni(NO_3)_2$

$= \frac{2 \times 500}{1000} = 1$mole .

On reduction of Ni^{2+}

$Ni^{2+} + 2\bar{e} \dashrightarrow Ni$

Moles deposited = $\frac{104220}{2 \times 96500} = 0.54$ mol

No of mol left = 1 – 0.54 = 0.46 mol

Molarity of $Ni(NO_3)_2 = 2 \times 0.46 = 0.92$ mol/litre

82 . (2) If iron reacts with dil . H_2SO_4 it replaces hydrogen. Lead when reacts with dil. H_2SO_4 it also replaces hydrogen but such replacement of hydrogen is not continuous, after formation of $PbSO_4$ on the lead surface replacement of hydrogen stops. Copper and mercury does not replaces hydrogen when reacts with dil H_2SO_4.

83 . (3) Supercritical CO_2 is used as a solvent for extraction of organic compounds from natural sources.

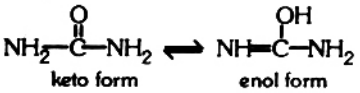
84 . (4) E° cell = $\frac{2.303RT}{nF}$ log Keq .

$$0.295 = \frac{2.303 \times 8.314 \times 298}{2 \times 96500} \log Keq$$

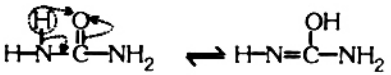
$$\log Keq = \frac{2.303 \times 96500 \times 0.295}{2.303 \times 8.314 \times 298} = 10$$

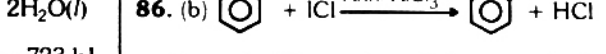
Keq = antilog 10 = 1×10^{10}

85 . (4) Urea shows tautomerism (dynamic equilibrium isomerism)



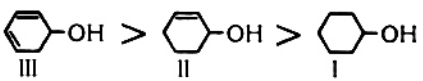
Mechanism :-



86. (b)  + HCl

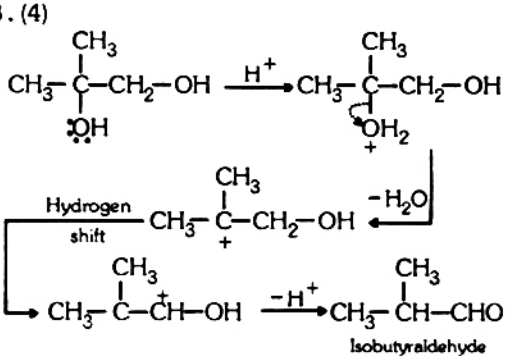
Here, in this reaction Cl is more electronegative that is why iodine will behave as electrophile. The path will be electrophillic substitution reaction .

87 . (2)



Ease of dehydration is directly proportional to number of unsaturation . Conjugated diene dehydrates easily than normal diene .

88 . (4)



89 . (3) On hydrolysis ester gives acid and alcohol .

$$\text{Ester} \xrightarrow{\text{hydrolysis}} \text{Acid} + \text{Alcohol}.$$

Methyl acetate gives methanol and ethyl acetate gives ethanol. Methanol does not gives holoform (Iodoform test) where as ethanol gives iodoform test .

90 .(3) $C_2H_5 - NH_2 + S = C = S$

$$\dashrightarrow C_2H_5 - NH - \overset{\overset{S}{\|}}{C} - SH$$

$$\xrightarrow{HgCl_2} HgS + 2HCl + \underset{\text{ethyl isothiocyanate}}{C_2H_5 - N = C = S}$$

The formed compound i-e ., ethyl isothiocyanate, is having mustard oil like odour, this reaction that is why known as Hofmann's mustard oil reaction .

91 . (3) Protein can be denatured by heat. It can also be denatured by strong alkali or strong acids, even strong electrolyte is also capable to denature the protein .

92 . (3) Acetyl salicylate or aspirin is used as analgesic and blood thinning agent as well .

93 . (4)

$$2CuSO_4 + K_4[Fe(CN)_6] \longrightarrow \underset{\text{Red brown ppt}}{Cu_2[Fe(CN)_6]} + 2K_2SO_4$$

94 . (4) On electric discharge at low pressure through neon gas at very low pressure an orange coloured glow can be seen . Such kind of lamp is used in electric line tester. Commercial hoardings of sign boards generally contains neon lamp .

95 . (2) Any catalyst lowers the activation energy of the reaction. The catalysis follows the adsorption phenomenon, which provide the space for reactants to react with each other by avoiding random movement .

96 . (2)) According to Langmuir adsorption isotherm,

$$\frac{x}{m}\text{ (extent of adsorption)} = \frac{aP}{1 + bP}$$

At high pressure, 1 + bp. = bp

or, $$\frac{x}{m} = \frac{aP}{bP} = \frac{a}{b}$$

97 . (1) Molar concentration of urea $= \frac{10}{60}$ per dm^3

Molar concentration of volatile solute solution

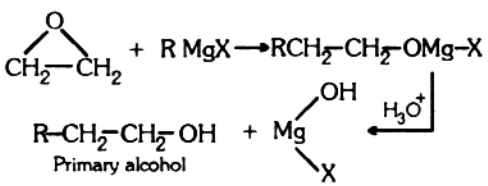
$= \frac{5}{M}$ per 100 ml. or, $\frac{50}{M}$ per dm^3 .

For solution of same concentration

or, isotonic solution at same temperature .

$$\frac{10}{60} = \frac{50}{M} \quad \text{or, } M = 300 \text{ g mol}^{-1} .$$

98 . (4)



99 . (3) Saponification value :– It is the number of mg of KOH (milligrams of KOH) required to neutralize completely the fatty acid resulting from the complete hydrolysis of 1 gram of fat or oil .

100 . (2) Rayon resembles silk in appearance, hence, it is called as artificial silk . It is man made fibre.

$$\underset{\text{(pulp)}}{\text{Cellulose}} \xrightarrow[CS_2]{NaOH} \text{Viscose Pulp} \xrightarrow[\text{(spinner)}]{\text{dil } H_2SO_4} \underset{\text{(silk thread)}}{\text{Rayon}}$$

101 . (3) If the size of central atom increases bond angle decreases it is due to the fact that lone pair (lp) bond pair (bp) repulsion is strong in larger bond length and vice-versa .

102 . (2) The quantity of radioactive substance decayed during its average life is calculated by using equation

$$\lambda = \frac{0.693}{t_{1/2}} = \frac{2.303}{1.44\, t_{1/2}} \log \frac{100}{Nt}$$

103 . (a) According to van der Waals' equation

$$\left(P + \frac{a}{V^2}\right)(v - b) = RT.$$

at very high pressure $\mathbf{P(V - b) = RT}$.

or, $$PV - Pb = RT$$

$$\frac{PV}{RT} = \left(1 + \frac{Pb}{RT}\right)$$

$$Z = \left(1 + \frac{Pb}{RT}\right) \quad \left| \text{where } Z = \left(\frac{PV}{RT}\right) \right.$$

104 . (2) Any fluid (Liquid and gas) absorbs heat energy and due to this kinetic energy or motion (random motion) increases, which leads to decrease in viscosity of the liquid .

105 . (4) $CaF_2 \rightleftharpoons Ca^{2+} + 2F^-$

$$K = \left(\frac{10^{-6}}{2}\right)\left(\frac{10^{-6}}{2}\right)^2 = 1.25 \times 10^{-19} < Ksp.$$

Precipitation will not form because ionic product is less than solubility product (Ksp)

106 . (2) Common ion adsorb on the surface of precipitate . Due to repulsion between adsorbed ions, the precipitates undergo fragmentation resulting in colloidal state.

107 . (1) For the reaction

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$; $\Delta H = -ve$.

$\Delta H = \Delta E + \Delta nRT$.

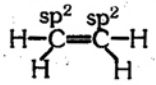
$\Delta n = n_p - n_r = 1 - 3 = -2$

$\Delta H = \Delta E - 2T$

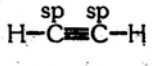
$\Delta H < \Delta E$.

108 . (1) Electric current carried by cation (+ve ion) and anion (– ve ion) is equal to their transport number .

109. (2) In the case of ethene carbon atom is sp^2 hybridized and in ethyne carbon atom is sp hybridized.



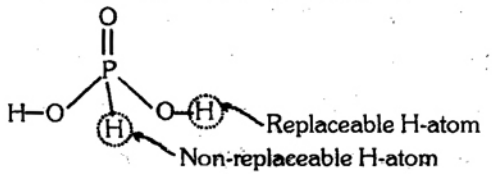
Ethene



Ethyne

110. (4) Mercury vapour are invisible as no metallic bonding is possible in vapour phase.

111. (3) H_3PO_3, Orthophosphoric acid is a dibasic acid (two replaceable hydrogen atom attached to –O–H bond with central). Its structure is



112. (4) In F_2 molecule F–F bond is weaker than Cl – Cl bond of Cl_2 molecule. This anomalous behaviour of F-F bond strength against small bond length is due to repulsion of electrons (lone pair) of one F atom with the other.

113. (1) During the electrolysis of NaCl (aq), sodium is preferentially discharged at mercury cathode forming sodium amalgam (Hg– Na), it is due to this fact hydrogen has a high over voltage at Hg – cathode.

114. (4) KCN form complex compound with Cu^+ and Cd^{2+} as $K_3[Cu(CN)_4]$ and $K_2[Cd(CN)_4]$ respectively. When H_2S gas pass through these, Cd^{2+} complex gets decomposed to yellow Cadmium sulphide precipitate.

115. (1) It is true that amines are more basic than esters / ethers due to the nitrogen atom is less electronegative than oxygen.

116. (3) Due to the presence of intermolecular H-bonding in alcohol its boiling point is higher. But this type of intermolecular hydrogen bonding does not exist in ether that is why their boiling point is less.

117. (1) $NaCNS + FeCl_3 \longrightarrow \underset{\text{red colour}}{Fe(CNS)_3} + 3NaCl$

118. (3) $NaCl + HCl \xrightarrow[\text{pure}]{} NaCl + H^+ + Cl^-$.

Pure form of NaCl can be obtained when HCl gas is passed in a saturated solution of NaCl, because the value of $[Na^+]$ and $[Cl^-]$ > Ksp of NaCl.

119. (4) Chlorine is good oxidizing agent. Fluorine is not good oxidizing agent because fluorine is highly electronegative element.

120. (1) During hydrolysis H_2O is taken in large excess, therefore its concentration does not change.

121. (3) The heart's "natural" pacemaker is called the sinoatrial (SA) node or sinus node. It's a small mass of specialized cells in the top of the right atrium (upper chamber of the heart). It produces the electrical impulses that cause your heart to beat.

A chamber of the heart contracts when an electrical impulse or signal moves across it. For the heart to beat properly, the signal must travel down a specific path to reach the ventricles (the heart's lower chambers). Heart rhythm problems may occur when the natural pacemaker is defective, causing the heartbeat to be too fast, too slow or irregular. Rhythm problems also can occur because of a blockage of your heart's electrical pathways.

Artificial pacemaker : A device that uses electrical impulses to regulate the heart rhythm or to reproduce that rhythm. An internal pacemaker is one in which the electrodes into the heart, the electronic circuit and the power supply are implanted (internally) within the body.

Although there are different types of pacemakers, all are designed to treat bradycardia, a heart rate that is too slow. Pacemakers may function continuously and stimulate the heart at a fixed rate or at an increased rate during exercise.

122. (2) DNA replication is semiconservative. Semiconservative replication would produce molecules with both old and new DNA, but each molecule would be composed of one old strand and one new one. The newly synthesized strand of DNA would be normal while the strand obtained from parent molecule would be radioactive.

123. (2) A plasmid is an independent, circular, self-replicating DNA molecule that carries only a few genes. The number of plasmids in a cell generally remains constant from generation to generation. Plasmids are autonomous molecules and exist in cells as extrachromosomal genomes, although some plasmids can be inserted into a bacterial chromosome, where they become a permanent part of the bacterial genome. It is here that they provide great functionality in molecular science.

Plasmids used in genetic engineering are called vectors. They are used to transfer genes from one organism to another and typically contain a genetic marker conferring a phenotype that can be selected for or against. Most also contain a polylinker or multiple cloning site (MCS), which is a short region containing several commonly used restriction sites allowing the easy insertion of DNA fragments at this location.

124. (3)

RRTt (Red tall) X rrtt (white dwarf)

Fertilization

RT Rt rt rt Gametes

	rt	rt
RT	RrTt	RrTt
Rt	Rrtt	Rrtt

Phenotype of different plants is

(i) All plants contain red fruits

(ii) 50% plants are tall with red fruits

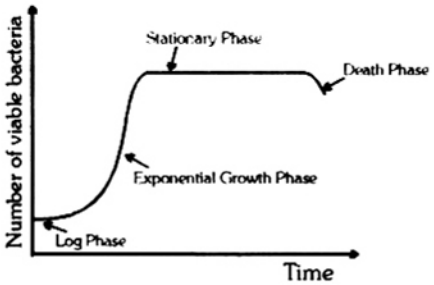
(iii) 50% plants are dwarf with red fruits.

125. (2) **Na^+ ions** are found in higher concentrations outside the cell, and in low concentration inside the cell. Conversely, **K^+ ions** are distributed in high concentration inside the cell and in low concentration outside the cell. When the neuron is excited, there is a marked change in the potential from the resting level to zero and it become 20 or 30 mV. When a stimulus is provided, there is a rapid inward movement of Na^+ ions to make the inside positively charged. When the outflux of K^+ ions can no longer keep pace with the faster influx of Na^+. This causes an action potential.

126. (2) Cholera is an acute diarrhoeal infection caused by ingestion of the bacterium *Vibrio cholerae*. Transmission occurs through direct faecal-oral contamination or through ingestion of contaminated water and food. The disease is characterized in its most severe form by a sudden onset of acute watery diarrhoea that can lead to death by severe dehydration and kidney failure. More commonly, the disease progresses from the first liquid stool to shock in 4 to 12 hours, with death following in 18 hours to several days without rehydration treatment

Rehydration is the replenishment of water and electrolytes lost through dehydration. It can be performed by oral rehydration therapy (drinking an electrolyte solution) or by intravenous therapy (adding fluid and electrolytes directly into the blood stream). Administration of saline not only supports sodium-potassium pump through which water in cell is restored, but glucose is also absorbed along with sodium.

127. (1) The schematic growth curve shown below is associated with simplistic conditions known as a batch culture. It refers to a single bacterial culture, introduced into and growing in a fixed volume with a fixed (limited) amount of nutrient.



Lag Phase: Bacteria are becoming "acclimated" to the new environmental conditions to which they have been introduced (pH, temperature, nutrients, etc.). There is no significant increase in numbers with time.

Exponential Growth Phase: The living bacteria population increases rapidly with time at an exponential growth in numbers, and the growth rate increasing with time. Conditions are optimal for growth.

Stationary Phase: With the exhaustion of nutrients and build-up of waste and secondary metabolic products, the growth rate has slowed to the point where the growth rate equals the death rate. Effectively, there is no net growth in the bacteria population.

Death Phase: The living bacteria population decreases with time, due to a lack of nutrients and toxic metabolic by-products.

128. (1) Xylem vessels – consist of dead hollow cells because the walls are lignified and the cell contents disintegrate. The lignin makes the cell wall impermeable so they are in effect water proof. It also makes the vessels extremely strong and prevents them from collapsing. They have a wide lumen and are linked end to end to create a long, hollow tube since the end cell walls have one or many perforations in them. This allows the transport of large volumes of water. The sidewalls have bordered pits (unlignified areas) to allow lateral movement of water. Xylem vessels are found in angiosperms.

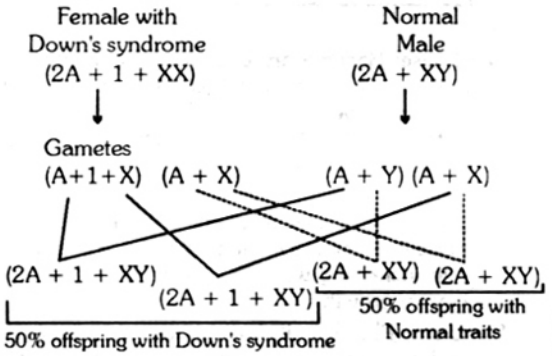
Tracheids – similar to vessels but with narrower lumens and connected by pits. They have tapered ends so that they dovetail together. Tracheids are found in conifers.

129. (1) During the process of translation an initial complex is formed between mRNA, 30S ribosomal subunit and methionyl tRNA.. This complex is formed due to association of $1F_1$, $1F_2$, $1F_3$ initiation factors and GTP molecule.

Initiation – Small subunit of ribosome (30s) attached to the 5' end of mRNA and with the first codon of mRNA (AUG) forms the initiation complex. Than the large subunit of ribosome combines with

the initiation complex GTP and three protein factors IF , IF_2 and IF_3, loosely associated with the small ribosomal subunit are involved in the initiation of polypeptide chain formation.

130. (1) People with Down Syndrome have 3 copies of chromosome 21. For this reason, Down Syndrome is also called "Trisomy 21". In 90% of Trisomy 21 cases, the additional chromosome comes from the mother's egg.



131. (3) A species is often defined as a group of organisms capable of interbreeding and producing fertile offspring. The plant tobacco (*Nicotiana*) has two different species and these two species cannot reproduce freely.

132. (1) A keystone species is a species whose very presence contributes to a diversity of life and whose extinction would consequently lead to the extinction of other forms of life. Keystone species help to support the ecosystem (entire community of life) of which they are a part.

Example: Elephants as Keystone Species in Grasslands

Elephants appear to be keystone species in African grasslands. That is, without elephants (or some other player to fill the elephants' role), the grasslands actually cease to exist as grasslands. Take away the elephants, and the grasslands, which overgrow with woody plants, convert to forests or to shrub-lands.

133. (3) Electron Spin Resonance Dating falls into the group of dating methods that uses radiation exposure to date many materials found at archaeological sites. It is also known as a Radiometric Dating Method. This technique is mostly used to date minerals. It has been used to date such things as sedimentary quartz, fossilized teeth, flint, and calcium carbonate in limestone, coral and egg shells.

This method works by using radiation to cause electrons to separate from the atoms. These electrons then become trapped in the crystal lattice of minerals. This changes the magnetic field of the material at a rate that is predictable, allowing it to be used to date an item. It can be used to date when mineralization, sedimentation, or the last heating of minerals took place. It is often used to date quartz from meteorite strikes, and places where earthquake activity has taken place.

Fossil DNA is a potential source of information on the evolution, population dynamics, migrations, diets and diseases of animals and humans. But if it is not well preserved or becomes contaminated by modern DNA, the results are uninterpretable. It was in 1986 that Weiner first reported the existence of crystal clusters in fresh bones. Now, almost 20 years later, Weiner and Salamon have returned to these findings, reasoning that fossil bones might possess such crystal structures containing preserved ancient DNA.

134. (4) A telomere is a region of highly repetitive DNA at the end of a linear chromosome that functions as a disposable buffer. Every time linear chromosomes are replicated during late S phase, the DNA polymerase complex is incapable of replicating all the way to the end of the chromosome; if it were not for telomeres, this would quickly result in the loss of vital genetic information, which is needed to sustain a cell's activities. Every time a cell with linear chromosomes divides, it will lose a small piece of one of its strands of DNA.

Like the rest of a chromosome and its genes, telomeres are sequences of DNA - chains of chemical code. Like other DNA, they are made of four nucleic acid bases: G for guanine, A for adenine, T for thymine and C for cytosine.

Telomeres are made of repeating sequences of TTAGGG on one strand of DNA bound to AATCCC on the other strand. Thus, one section of telomere is a "repeat" made of six "base pairs."

135. (4) Thymus: A lymphoid organ situated in the center of the upper chest just behind the sternum (breastbone). It is in the thymus that lymphocytes mature, multiply, and become T cells. (That is why they are called T cells. The T is for thymus.)

Congenital absence of the thymus (congenital athymia) or loss of the thymus in the newborn period (neonatal thymectomy) results in complete lack of functional T cells and immune deficiency.

136. (1) In certain species of diatoms, auxospores are specialised cells that are produced at key stages in their cell cycle or life history. Auxospores typically play a role in growth processes, sexual reproduction or dormancy ("resting spores".)

Bozi (1914) and Fremi (1930) reported Cell division crosswise to the trichome length of *Wertiella lanosa*. Reproduction by (3-13-celled) hormocysts, which arise at the ends of branches, solitary or up to four in series; cells in hormocysts wider than in branches, constricted at cross walls; during the ger-

mination of hormocysts, the single heterocytes usually develop (both heteropolar or isopolar germlings arise).

137. (1) The visible spectra or photosynthetic active radiation has a range of wavelength of 380 nm to 760 nm, which is part of electromagnetic spectrum responsible for photosynthesis.

138. (4) Magnesium is a critical structural component of the chlorophyll molecule and is necessary for functioning of plant enzymes to produce carbohydrates, sugars and fats. It is used for fruit and nut formation and essential for germination of seeds. Deficient plants appear chlorotic, show yellowing between veins of older leaves; leaves may droop. Magnesium is leached by watering and must be supplied when feeding. It can be applied as a foliar spray to correct deficiencies.

Iron is necessary for many enzyme functions and as a catalyst for the synthesis of chlorophyll. It is essential for the young growing parts of plants. Deficiencies are pale leaf color of young leaves followed by yellowing of leaves and large veins. Iron is lost by leaching and is held in the lower portions of the soil structure. Under conditions of high pH (alkaline) iron is rendered unavailable to plants. When soils are alkaline, iron may be abundant but unavailable. Applications of an acid nutrient formula containing iron chelates, held in soluble form, should correct the problem.

139. (2) Inbreeding depression is usually defined as the lowered fitness or vigour of inbred individuals compared with their non-inbred counterparts, observed in many (but by no means all) organisms. Its converse is heterosis, the '*hybrid vigour*' manifested in increased size, growth rate or other parameters resulting from the increase in heterozygosity in F_1 generation crosses between inbred lines. In maize, hybrid vigour is exploited by crossing to two inbred parental lines.

140. (1) tRNA is the information adapter molecule. It is the direct interface between amino-acid sequence of a protein and the information in DNA. Therefore it decodes the information in DNA.

Messenger or mRNA is a copy of the information carried by a gene on the DNA. The role of mRNA is to move the information contained in DNA to the translation machinery.

Three of the rRNA molecules are synthesized in the nucleolus, and one is synthesized elsewhere.

The Peptidyl transferase is an aminoacyltransferase and the primary enzymatic function of the ribosome which forms peptide links between adjacent amino acids using tRNAs during the translation process of protein biosynthesis.

141. (1) Hybridoma cells are cells that have been engineered to produce a desired antibody in large amounts. To produce monoclonal antibodies, B-cells are removed from the spleen of an animal that has been challenged with the relevant antigen. These B-cells are then fused with myeloma tumor cells that can grow indefinitely in culture (myeloma is a B-cell cancer). This fusion is performed by making the cell membranes more permeable. The fused hybrid cells (called hybridomas), being cancer cells, will multiply rapidly and indefinitely and will produce large amounts of the desired antibodies

142. (3)

143. (2) Definitions of lung volumes

Lung volume	Definition
Tidal volume (TV)	The volume of air moved during normal quiet breathing (about 0.5 L).
Inspiratory reserve volume (IRV)	The volume of air that can be forcefully inspired following a normal quiet inspiration. (about 2.5 - 3.5 L).
Expiratory reserve volume (ERV)	The volume of air that can be forcefully expired after a normal or resting expiration (about 1.0 L).
Residual volume (RV)	The volume of air remaining in the lungs after a forceful expiration (about 1.0 L).
Vital capacity (VC)	The greatest extreme in air volume moved between inspiration and expiration (about 4.5 L).
Inspiratory capacity (IC)	The amount of air that the lungs will hold after a normal expiration (i.e. inspiratory reserve + tidal volume).
Functional residual capacity (FRC)	The amount of air remaining in the lungs after a normal quiet expiration (i.e. expiratory reserve volume + residual volume).

144. (1) Nitrogen is a major component of proteins, hormones, chlorophyll, vitamins and enzymes essential for plant life. Nitrogen metabolism is a major factor in stem and leaf growth (vegetative growth). Too much can delay flowering and fruiting. Deficiencies can reduce yields, cause yellowing of the leaves and stunt growth.

145. (3) Arothropods have jointed appendages, usually one pair to a somite.

146. (1) Diphtheria is a bacterial infection that spreads easily and occurs quickly. It mainly affects the nose and throat.

In its early stages, diphtheria can be mistaken for a bad sore throat. A low-grade fever and swollen neck glands are the other early symptoms.

The toxin, or poison, caused by the bacteria can lead to a thick coating in the nose, throat, or airway. This coating is usually fuzzy gray or black and can cause breathing problems and difficulty in swallowing. The formation of this coating (or membrane) in the nose, throat, or airway makes a diphtheria infection different from other more common infections (such as strep throat) that cause sore throat.

147. (1) Biogenetic law : a law stating that the earlier stages of embryos of species advanced in the evolutionary process, such as humans, resemble the embryos of ancestral species, such as fish. The law refers only to embryonic development and not to adult stages; as development proceeds, the embryos of different species become more and more dissimilar. An early form of the law was devised by the 19th-century Estonian zoologist K. E. von Baer, who observed that embryos resemble the embryos, but not the adults, of other species. A later, but incorrect, theory of the 19th-century German zoologist Ernst Heinrich Haeckel states that the embryonic development (ontogeny) of an animal recapitulates the evolutionary development of the animal's ancestors (phylogeny).

148. (3) Activated sludge is a process dealing with the treatment of sewage and industrial waste waters. Atmospheric air or pure oxygen is bubbled through primary treated sewage (or industrial waste water) combined with organisms to develop a biological floc which reduces the organic content of the sewage. The combination of raw sewage (or industrial waste water) and biological mass is commonly known as Mixed Liquor. In all activated sludge plants, once the sewage (or industrial waste water) has received sufficient treatment, excess mixed liquor is discharged into settling tanks and the treated supernatant is run off to undergo further treatment before discharge. Part of the settled material, the sludge, is returned to the head of the aeration system to re-seed the new sewage (or industrial waste water) entering the tank. This fraction of the floc is called Return Activated Sludge (R.A.S.). Excess sludge which eventually accumulates beyond what is returned is called Waste Activated Sludge (W.A.S.). W.A.S is removed from the treatment process to keep the ratio of biomass to food supplied (sewage or waste water) in balance. This is called the F:M ratio. W.A.S is stored away from the main treatment process in storage tanks and is further treated by digestion, either under anaerobic or aerobic conditions prior to disposal

149. (4) Cellulose is an organic compound with the formula $(C_6H_{10}O_5)_n$. It is a structural polysaccharide derived from beta-glucose. Cellulose is the primary structural component of green plants. The primary cell wall of green plants is made of cellulose; acetic acid bacteria are also known to synthesize cellulose, as well as many forms of algae, and the oomycetes.

Cellulose is derived from (β-glucose), which condense through β(1→ 4)-glycosidic bonds. This linkage motif contrasts with that for a(1 → 4)-glycosidic bonds present in starch and other carbohydrates. Cellulose is a straight chain polymer: unlike starch, no coiling occurs, and the molecule adopts an extended rod-like conformation.

150. (2) A blood glucose test measures the amount of a type of sugar, called glucose, in your blood. Glucose comes from carbohydrate foods. It is the main source of energy used by the body. Insulin is a hormone that helps your body's cells use the glucose. Insulin is produced in the pancreas and released into the blood when the amount of glucose in the blood rises. Normally, the blood glucose level is maintained between 70 to 150 mg/dL.

Several different types of blood glucose tests are used.

1. Fasting blood sugar (FBS) measures blood glucose after you have not eaten for at least 8 hours. It often is the first test done to check for diabetes. (70 to 100 mg/dL)
   - From 70 to 109 mg/dL normal glucose tolerance
   - From 110 to 125 mg/dL impaired glucose tolerance
   - 126 mg/dL and above probable diabetes
2. 2-hour postprandial blood sugar measures blood glucose exactly 2 hours after you eat a meal.
   - Less than 140 mg/dL normal glucose tolerance
   - From 140 to 200 mg/dL impaired glucose tolerance
   - Over 200 mg/dL probable diabetes
3. Random blood sugar (RBS) measures blood glucose regardless of when you last ate. (70 to 150 mg/dL)

151. (3) Hypercholesterolemia is a condition characterized by very high levels of cholesterol in the blood. Cholesterol is a waxy, fat-like substance that is produced in the body and obtained from foods that come from animals (particularly egg yolks, meat, poultry, fish, and dairy products). The body needs this substance to build cell membranes, make certain hormones, and produce compounds that aid in fat digestion. Too much cholesterol, however, increases a person's risk of developing heart disease.

People with hypercholesterolemia have a high risk of developing a form of heart disease called coronary artery disease. This condition occurs when excess cholesterol in the bloodstream is deposited in the walls of blood vessels, particularly in the arteries that supply blood to the heart (coronary arteries). The abnormal buildup of cholesterol forms clumps (plaque) that narrow and harden artery walls. As the clumps get bigger, they can clog the arteries and restrict the flow of blood to the heart. The buildup of plaque in coronary arteries causes a form of chest pain called angina and greatly increases a person's risk of having a heart attack.

152. (2) *Rhizobium* (a nitrogen fixing bacteria) lives in symbiotic association in the root nodules of leguminous plants.

Yeast - fermentation (production of alcohol)

Myxomycetes is a class of fungi containing the slime molds, which occur on rotting vegetation but are not pathogenic for humans.

Ringworm, also known as "Tinea", is an infection of the skin, characterized by a reddish to brownish raised or bumpy patch of skin that may be lighter in the center, giving the appearance of a 'ring'. Contrary to its name, ringworm is not caused by a worm but by parasitic fungi (Dermatophytosis).

A mycorrhiza is a symbiotic (occasionally weakly pathogenic) association between a fungus and the roots of a plant. In a mycorrhizal association the fungus may colonize the roots of a host plant either intracellularly or extracellularly.

This mutualistic association provides the fungus with relatively constant and direct access to mono- or dimeric carbohydrates, such as glucose and sucrose produced by the plant in photosynthesis. The carbohydrates are translocated from their source location (usually leaves) to the root tissues and then to the fungal partners. In return, the plant gains the use of the mycelium's very large surface area to absorb water and mineral nutrients from the soil, thus improving the mineral absorption capabilities of the plant roots

153. (1) National Institute of Virology – Pune

National Institute of Communicable disease – N.Delhi

National Institute of Nutrition – Hyderabad

Central Drug Research Institute – Lucknow

154. (3) Eutrophication is a process whereby water bodies, such as lakes, estuaries, or slow-moving streams receive excess nutrients that stimulate excessive plant growth (algae, periphyton attached algae, and nuisance plants weeds). This enhanced plant growth, often called an algal bloom, reduces dissolved oxygen in the water when dead plant material decomposes and can cause other organisms to die. Nutrients can come from many sources, such as fertilizers applied to agricultural fields, golf courses, and suburban lawns; deposition of nitrogen from the atmosphere; erosion of soil containing nutrients; and sewage treatment plant discharges. Water with a low concentration of dissolved oxygen is called hypoxic.

155. (4) Thalidomide, 2-(2,6-dioxopiperidin-3-yl)-1H-isoindole-1,3(2H)-dione, is a sedative, hypnotic, and multiple myeloma medication. Thalidomide was chiefly sold and prescribed during the late 1950s and early 1960s to pregnant women, as an antiemetic to combat morning sickness and as an aid to help them sleep. Before its release inadequate tests were performed to assess the drug's safety, with catastrophic results for the children of women who had taken thalidomide during their pregnancies. From 1956 to 1962, approximately 10,000 children were born with severe malformities, including phocomelia, because their mothers had taken thalidomide during pregnancy. Phocomelia is a congenital disorder involving the limbs

156. (2) Cretinism is a condition of severely stunted physical and mental growth due to untreated congenital deficiency of thyroid hormones (hypothyroidism).

The thymus is an endocrine gland of a pinkish-gray color, soft, and lobulated on its surfaces. At birth it is about 5 cm in length, 4 cm in breadth, and about 6 mm in thickness. The organ enlarges during childhood, and atrophies at puberty.

Parathormone (PTH) is made by the parathyroid glands, which are four pea-sized glands that lie behind the thyroid gland. If the blood calcium level is too low, the parathyroid glands release more PTH. This causes the bones to release more calcium into the blood and reduces the amount of calcium released by the kidneys into the urine. Also, vitamin D is converted to a more active form, causing the intestines to absorb more calcium and phosphorus. If the calcium level is too high, the parathyroid glands release less PTH, and the whole process is reversed.

The delta cells secrete somatostatin. This consists of two polypeptides, one of 14 amino acids and one of 28. Somatostatin has a variety of functions. Taken together, they work to reduce the rate at which food is absorbed from the contents of the intestine. Somatostatin is an inhibitor of the pituitary hormone somatotropin

157. (2) Blue Baby Syndrome - An illness that begins when large amounts of nitrates in water are ingested by an infant and converted to nitrite by the digestive system. The nitrite then reacts with oxyhemoglobin (the oxygen-carrying blood protein) to form metheglobin, which cannot carry oxygen. If a large enough amount of metheglobin is formed in

the blood, body tissues may be deprived of oxygen, causing the infant to develop a blue coloration of their mucous membranes and possibly digestive and respiratory problems. This condition is also known as methemoglobinemia.

158. (2) A polygene, multiple factor, or quantitative gene is a group of nonallelic genes that together influence a phenotypic trait. This results in the occurrence of intermediate forms between the parental type. In case of crossing between AABBCC (dark colour) and aabbcc (light colour), in F_2 generation seven phenotypes will be obtained in the ratio of 1 : 6 : 15 : 20 : 15 : 6 : 1. The total number of progeny is 64, out of which only two will be likely resemble with either parents i.e. < 5%.

159. (3) UAA is the 'stop' codon, hence, polypeptide chain will not grow after 24th amino acid. In the absence of new initiating codon rest of codons will not be able to translate.

160. (3) Y-chromosome plays no role in sex determination in Drosophila. Male determiners are located on autosomes. But in human beings Y-chromosome is required for development of a male sex character.

161. (2) Euglena is a genus of microscopic, one-celled organisms in the Protista kingdom. The name protozoa means "first animals." . Some taxonomists consider it a plants (due to presence of photosynthetic pigments) while others include them under animal kingdom along with protozoans because of their locomotion by flagella.

Protists are grouped into three major, unofficial categories based on means by which they obtain nutrition. These are the Protozoa, the Algae, and the Fungus-like

162. (2) Fungi reproduce by producing spores which are little more than a fragment of the parent fungus cell. Sexual reproduction is possible for some Fungi under certain conditions, but is infrequent. In most cases spores are produced without any cross-fertilization and, except for mutations, most spore are genetically identical to the parent cell. There are gradual and progressive simplification and ultimate elimination of the sexual apparatus from the lower to higher forms of fungi. In case of algae, the sexual apparatus increases in complexity from the simple to higher forms.

163. (1) All organisms that do not posses a membrane-bound nucleus, including the Schizomycetes, or bacteria, the Cyanophyta, or blue-green algae, and the Prochlorophyta, are classified as belonging to the Kingdom Monera, and are referred to as being prokaryotic (meaning "having a primitive nucleus"). In addition to lacking a nuclear membrane, prokaryotic cells do not possess most of the other membrane-bound structures found in eukaryotic cells, or those cells that have a true nucleus. Prokaryotic cells lack endoplasmic reticulum, Golgi apparatus, and lysosomes. They also lack mitochondria although the inner surface of the prokaryotic cell membrane carries out a similar ATP-producing function.

164. (3) The resting potential is what would be maintained were there no action potentials, synaptic potentials, or other changes to the membrane potential. In neurons the resting potential is approximately -70 mV (the negative sign signifies excess negative charge inside the cell relative to the outside). At the resting potential, the net movement of sodium into the cell equals the net movement of potassium out of the cell.

165. (4) Arachidic acid, also called eicosanoic acid, is a saturated fatty acid found in peanut oil. Its name derives from the Latin arachis — peanut. It can be formed by the hydrogenation of arachidonic acid. It is practically insoluble in water, and stable under normal conditions.

In unsaturated fatty acids one or more alkenyl functional groups exist along the chain, with each alkene substituting a single-bonded " $-CH_2-CH_2-$" part of the chain with a double-bonded "$-CH=CH-$" portion (that is, a carbon double-bonded to another carbon).

166. (3) A non-protein component of an enzyme, which is required for catalytic activity, is known as co-enzyme or prosthetic group

Apoenzyme : It is the protein component of an enzyme, to which the coenzyme attaches to form an active enzyme. i.e. enzymes that require a cofactor but do not have one bound are called apoenzymes. An apoenzyme together with its cofactor(s) is called a holoenzyme (this is the active form).

167. (1) The genetic code is the set of rules by which information encoded in genetic material (DNA or RNA sequences) is translated into proteins (amino acid sequences) by living cells. Specifically, the code defines a mapping between tri-nucleotide sequences called codons and amino acids; every triplet of nucleotides in a nucleic acid sequence specifies a single amino acid. Translation starts with a chain initiation codon (start codon). The mRNA sequence AUG, which specifies methionine, the first amino acid used in the translation process. (Occasionally GUG, valine, is recognized as an initiation codon).

Amber codon is the polypeptide chain-termination messenger-RNA codon UAG, which brings about the termination of protein translation. It a a nonsense codon. One of the mRNA sequences (UAA, UAG, UGA) that signals the termination of translation. A codon for which no normal tRNA molecule exists. The presence of a nonsense codon causes

termination of translation (ending polypeptide chain synthesis). There are three nonsense codons are called amber(UAG) ochre(UAA) and opal (UGA). UAG is amber, UGA is opal (sometimes also called umber), and UAA is ochre.

168. (1) In cymose tap root system, the primary root itself stops growing after some time and secondary root carry on further growth of the root system. In cymose tap root system oldest branch lies very near the growing point of the root while the youngest one is farthest away from it. It is found in shallow rooted plants such as pea, gram etc.

169. (3) The female gametophye, the embryosac was first observed by Hofmeister. Embryo sac are of two types : allium-type and polygonum-type.

The female gametophyte of angiosperms, generally an eight-nucleate, seven-celled structure. The seven cells are the egg cell, two synergids and three antipodals (each with a single nucleus), and the central cell (with two nuclei). In the polygonum-type, megasporogenesis results in four well-defined megaspores, one of which gives rise to the embryo sac. Most commonly the megaspore farthest from the micropyle is functional. The definitive feature of the allium-type arises from abortion of one of the two dyad cells produced after the first meiotic division of the megasporocyte. The nucleus of the surviving dyad cell divides to form two haploid nuclei, which are interpreted as megaspore nuclei.

170. (1) Root Tip: the end 1 cm of a root contains young tissues that are divided into the root cap, quiescent center, and the subapical region. Quiescent Center: behind the root cap is the quiescent center, a region of inactive cells. They function to replace the meristematic cells of the rootcap meristem. The quiescent center is also important in organizing the patterns of primary growth in the root.

171. (3) Formative phase is also known as phase of cell formation or cell division. In this, new cells are formed from pre-existing cells through mitotic division. Cell division phase occurs in actively growing regions such as shoot apex and root apex.

172. (1) Oxygen is required to generate sufficient respiratory energy to drive N_2 fixation. But too much oxygen inactivates nitrogenase. Biological Nitrogen Fixation (BNF) occurs when atmospheric nitrogen is converted to ammonia by a pair of bacterial enzymes called nitrogenase

In root nodules the O_2 level is regulated by a special hemoglobin - leghemoglobin. The globin protein is encoded by plant genes but the heme cofactor is made by the symbiotic bacteria. This is produced only when the plant is infected with Rhizobium. The plant root cells convert sugar to organic acids which they supply to the bacteroids. In exchange, the plant receives amino-acids (rather than free ammonia).

173. (3) **Imbibition** – Adsorption of water by the dry hydrophilic colloids is called imbibition. It is a physical process which is involved in the movement of water. For example if a piece of dry wood is put in water, it swells in size because of imbibition. This is because wood is made up of cellulose, lignin or pectin and other substances which are hydrophilic colloids. Dry seed imbibe large amount of water, which helps in breaking of the seed coat. Such a substance which imbibes water is called **imbibant**. During imbibition the imbibant increases in volume, thus develops pressure called **imbibition pressure**. The increase in the volume of pea seeds results in blowing off the lid placed over the tin.

174. (2) Cyclic pathway of photosynthesis appeared first in some eubacterial species for ATP production. Non cyclic photophosphorylation is the only natural process which adds molecular oxygen to the atmosphere by the photolysis of water.

175. (3) Organochlorines are basically organic compounds that have been chlorinated and have very low bio-degradation and gets accumulated in environment.

Fenitrothion is the common name for O,O-dimethyl-O-(4-nitro-meta-tolyl) It is a broad-spectrum organophosphorus pesticide.

176. (3) Tropical rain forests once blanketed the Earth like a wide green belt around the equator. Just a few thousand years ago rain forests covered 14 percent of the Earth's land surface, or 5 billion acres.

Humans already have destroyed half of this forest area, with most damage occurring in the last 200 years. With just 2.5 million square miles (647 million hectares) of tropical rain forest remaining, we continue to lose an estimated 93,000 square miles (150,000 square km) a year.

Although tropical rain forests now cover just 2 percent of the globe, they are home to more than half the world's living plant and animal species.

177. (2) Gene flow—also called migration—is any movement of genes from one population to another. Gene flow includes lots of different kinds of events, such as pollen being blown to a new destination or people moving to new cities or countries. If genes are carried to a population where those genes previously did not exist, gene flow can be a very important source of genetic variation. This migration affects the allele frequency of both donor and recipient populations.

178. (1) A cell found in connective tissue that contains numerous basophilic granules and releases sub-

stances such as heparin and histamine in response to injury or inflammation of bodily tissues. Also called labrocyte, mastocyte. Mast cells and basophils play a central role in inflammatory and immediate allergic reactions. They are able to release potent inflammatory mediators, such as histamine, proteases, chemotactic factors, cytokines and metabolites of arachidonic acid that act on the vasculature, smooth muscle, connective tissue, mucous glands and inflammatory cells. Mast cells settle in connective tissues and usually do not circulate in the blood stream.

179. (1) The muscles of alimentary canal are made of smooth muscle, under involuntary control. It can be subdivided into circular muscle (which squeezes the gut when it contracts) and longitudinal muscle (which shortens the gut when it contracts). The combination of these two muscles allows a variety of different movements. These muscles facilitate the movement of food particles through alimentary canal. Large food particles are broken down into small, semi liquid particles by the action of these muscles. Later also help in the forward flow of food material (peristalsis) and mixing of enzymes coming from different glands related to alimentary canal.

180. (1) Phenylketonuria (PKU) is a genetic disorder that is characterized by an inability of the body to utilize the essential amino acid, phenylalanine. Amino acids are the building blocks for body proteins. 'Essential' amino acids can only be obtained from the food we eat as our body does not normally produce them. In 'classic PKU', the enzyme that breaks down phenylalanine phenylalanine hydroxylase, is completely or nearly completely deficient. This enzyme normally converts phenylalanine to another amino acid, tyrosine. Without this enzyme, phenylalanine and its' breakdown chemicals from other enzyme routes, accumulate in the blood and body tissues Although the term 'hyperphenylalaninemia' strictly means elevated blood phenylalanine, it is usually used to describe a group of disorders other than classic PKU. These other disorders may be caused by a partial deficiency of the phenylalanine breakdown enzyme or the lack of another enzyme important to the processing of this amino acid. It results in a high level of phenylalanine in blood, other body fluids and urine.

181 . (2) convex **182** . (1) A.B. Vajpayee

183 . (2) days are nights are equal

184 . (2) Sarojini Naidu

185 . (2) attains enlightenment

186 . (4) emitting of light by a red hot platinum wire

187 (2) Anil Kumble

188 . (2) U.S. **189** . (1) Nalanda

190 . (1) conduction **191** . (3) Calculator

192 . (1) semi conductor **193** . (3) abstract thought

194 . (1) wax **195** . (3) glaucoma

196 . (2) BCG **197** . (3) keratin proteins

198 . (3) Chief Election Commissioner

199 . (3) bauxite

200 . (1) A period during the Gupta period