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 $\left(-\dfrac{1}{3}\right)$ 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) $T_n = \dfrac{T_i}{2}$
   (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 flux ϕ 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) $\dfrac{T}{4}$
   (2) $\dfrac{T}{8}$
   (3) $\dfrac{T}{12}$
   (4) $\dfrac{T}{2}$

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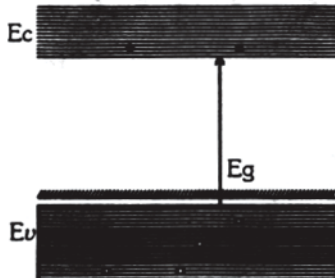
(1) p-type semiconductor
(2) insulator
(3) metal
(4) n-type semiconductor

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 $\left(\dfrac{1}{e}\right)^2$ after a time interval

(1) $\dfrac{1}{4\lambda}$
(2) 4λ
(3) 2λ
(4) $\dfrac{1}{2\lambda}$

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) $\dfrac{qvR}{2}$
(2) qvR^2
(3) $\dfrac{qvR^2}{2}$
(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
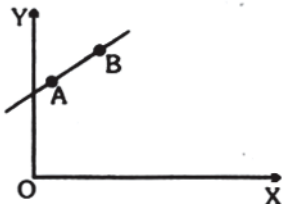
(1) $L_A > L_B$
(2) $L_A = L_B$
(3) the relationship between L_A and L_B depends upon the slope of the line AB
(4) $L_A < L_B$

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) 0.5π
(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?

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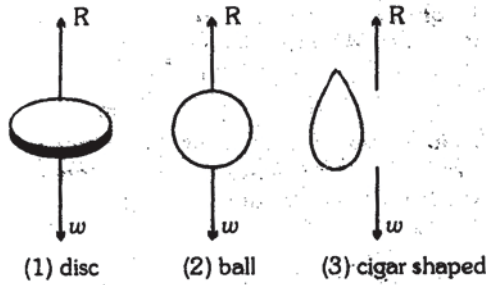
(1) $1 < 2 < 3$ (2) $2 < 3 < 1$

(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
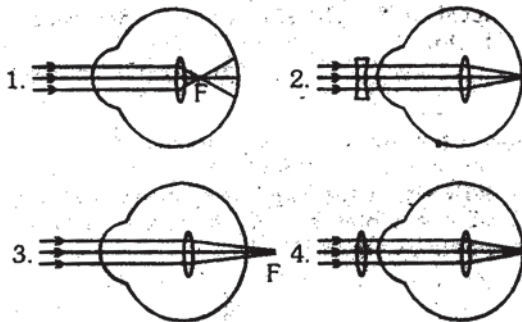
    (1) 1 represents far- sightedness
    (2) 2 correction for short -sightedness
    (3) 3 represents far - sightedness
    (4) 4 correction for far - sightedness

20.
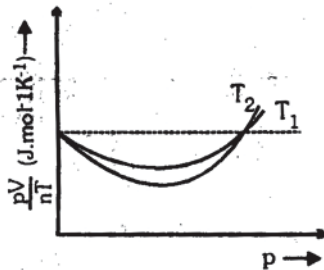
The figure shows the plot of $\frac{pV}{nT}$ versus p for oxygen gas at two different temperatures.

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

(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?
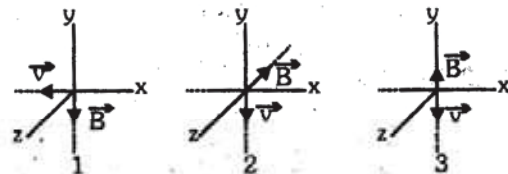

(1) + ve z – axis, – ve x– axis, + ve y – axis

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

(3) + ve z – axis, – ve x – 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?
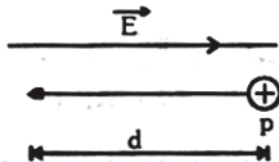

   (1) Negative, increase (2) Positive, decrease
   (3) Negative, decrease (4) Positive, increase

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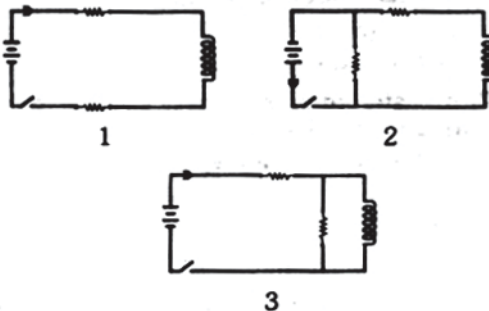
   (1) $i_2 > i_3 > i_1$ (2) $i_2 > i_1 > i_3$
   (3) $i_1 > i_2 > i_3$ (4) $i_1 > i_3 > i_2$

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?
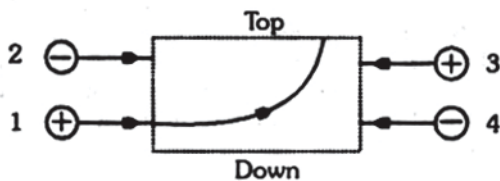

   (1) Top ; down, top down
   (2) Top ; down, down, top
   (3) Down ; top, top ; down
   (4) Down ; top, down, down

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, the 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
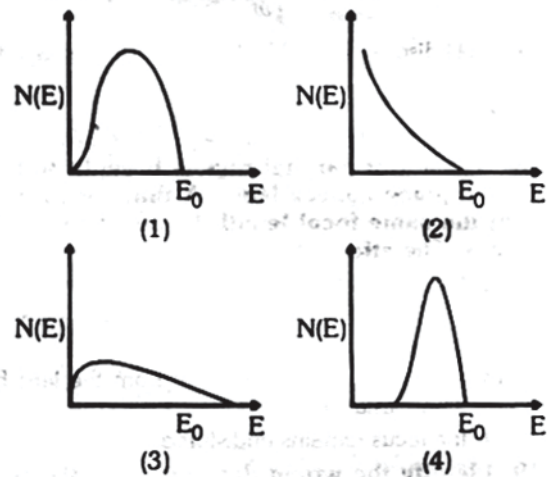
29. A sound absorber attenuates the sound level by 20 dB. The intensity decreases by a factor of
   (1) 1000   (2) 10000
   (3) 10   (4) 100

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
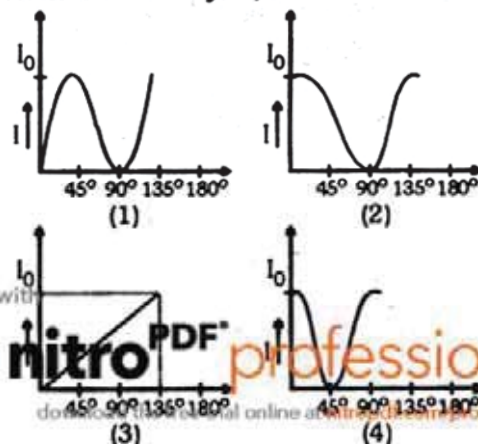
32. In a detector output circuit consists of $R = 10\, k\,\Omega$ and $C = 100\mu$ F. The frequency of carrier signal it can detect is

(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?
($h = 6.6 \times 10^{-34}$ J–s, 1 cal = 4.2 J)

(1) 1.5×10^{13} (2) 2.9×10^{13}

(3) 2.3×10^{19} (4) 1.75×10^{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 $R = \alpha E$ with $\alpha = 1$ cm / keV, obtain the binding energies of the two levels from which electrons are emitted. Given $h = 6.63 \times 10^{-34}$ J–s, $e = 1.6 \times 10^{-19}$ 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) $300\, \mu$ K   (2) $700\, \mu$ K

(3) $455\, \mu$ K   (4) $390\, \mu$ 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 1.25×10^9 yr. How old is the rock?

(1) 2.95×10^{11} yr   (2) 2.95×10^9 yr

(3) 4.37×10^9 yr   (4) 4.37×10^{11} yr

39. A particle is thrown above, then correct v - t graph will be
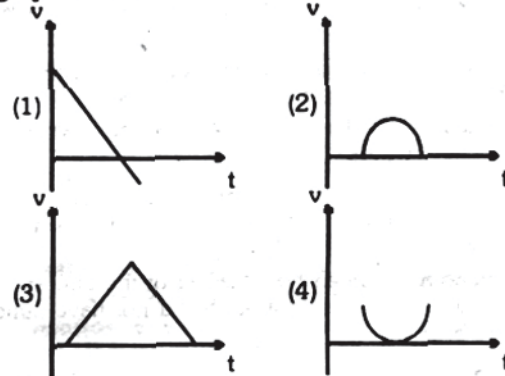
40. The speed (v) of ripples on the surface of water depends on surface tension (σ), density ((ρ) and wavelength (λ). The square of speed (v) is proportional to

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

(3) $\dfrac{\lambda}{\sigma\rho}$ (4) $\rho\lambda\sigma$

§ **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 is 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.
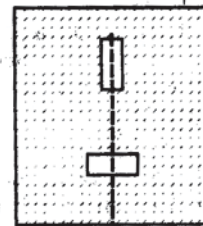
Reason : Net force on the cork is zero.

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.

CHEMISTRY

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 $CH_3 \overset{+}{\underset{(I)}{-\, CH \,-}} CH_3$

    $CH_3 \overset{+}{\underset{(II)}{-\, CH \,-}} OCH_3$

    $CH_3 \overset{+}{\underset{(III)}{-\, CH \,-}} COCH_3$
    - (1) I > II > III
    - (2) III > II > I
    - (3) II > III > I
    - (4) II > I > III

63. The IUPAC name of

    $CH_3 - \overset{\overset{CH_3}{|}}{C} - \overset{\overset{O}{||}}{C} - CH_2 - CH_2OH$ 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) orystal
    - (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,
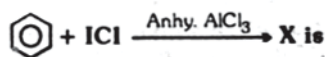
(a)   (b)

(c)   (d)

87. The correct order of ease of dehydration of following is
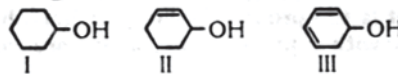
(1) I > II >III (2) III > II >I

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

88. The major product of the following reaction

is $CH_3 - \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle OH}{|}}{C}} - CH_2 - OH \xrightarrow{H_2SO_4}$
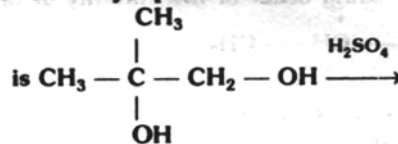
(1) $(CH_3)_2 C = CH_2$

(2) butan-2-one

(3) $(CH_3)_2 \overset{\overset{\displaystyle OH}{|}}{C} -- CHO$

(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
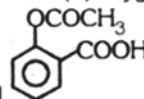
92. The compound is used as

(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

(1) red (2) green

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

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

97. **A solution containing 10g per dm^3 of urea (molecular mass = $60 gmol^{-1}$) 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 : $lp - lp$ 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 $\left(1 + \dfrac{Pb}{RT}\right)$

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 $10^{-6}M Ca^{2+}$ ion and 500 mL of $10^{-6}M F^{-1}$ ion, the precipitate of 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

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 sub-cutaneously 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 thymidine 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-tRNA

(2) association of 50S subunit of ribosome with initiation complex

(3) formation of formyl-met-tRNA

(4) binding of 30 subunit of ribosome with mRNA

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. tRNA	1. Linking of amino acids
B. mRNA	2. Transfer of genetic information
C. rRNA	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

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

(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

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

(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