01. A particle is thrown vertically upwards. Its velocity at half of the height is 10 m/s. Then, the maximum height attained by it is ($g = 10\ m/s^2$)

(a) 16 m (b) 10 m
(c) 20 m (d) 40 m

02. A physical quantity Q is calculated according to the expression

$$Q = \frac{A^3 B^3}{C\sqrt{D}}$$

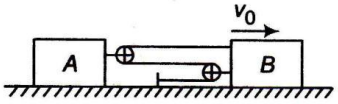
If percentage errors in A, B, C, D are 2%, 1%, 3% and 4% respectively. What is the percentage error in Q?

(a) ± 8% (b) ± 10%
(c) ± 14% (d) ± 12%

03. A projectile is thrown with an initial velocity of $(a\hat{i} + b\hat{i})\ ms^{-1}$. If the range of the projectile is twice the maximum height reached by it, then

(a) $a = 2b$ (b) $b = a$
(c) $b = 2a$ (d) $b = 4a$

04. Block B moves to the right with a constant velocity v_0. The velocity of body A relative to B is



(a) $\frac{v_0}{2}$, towards left (b) $\frac{v_0}{2}$, towards right
(c) $\frac{3v_0}{2}$, towards left (d) $\frac{3v_0}{2}$, towards right

05. A body is moving down an inclined plane of slope 37°. The coefficient of friction between the body and plane varies as $\mu = 0.3x$, where x is the distance travelled down the plane by the body. The body will have maximum speed. $\left(\sin 37° = \frac{3}{5}\right)$

($g = 10 m/s^2$)

(a) At $x = 1.16$m
(b) At $x = 2$ m
(c) At bottom of plane
(d) At $x = 2.5$ m

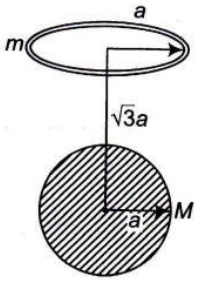
06. A stone is rotated in a vertical circle. Speed at bottommost point is $\sqrt{8gR}$, where R is the radius of circle. The ratio of tension at the top and the bottom is

(a) 1 : 2 (b) 1 : 3
(c) 2 : 3 (d) 1 : 4

07. A steel ball strikes a steel plate at an angle θ with the vertical. If the coefficient of restitution is e, the angle at which the rebound will take place is

(a) θ (b) $\tan^{-1}\left[\frac{\tan\theta}{e}\right]$
(c) $e \tan\theta$ (d) $\tan^{-1}\left[\frac{e}{\tan\theta}\right]$

08. A uniform ring of mass m is lying at a distance $\sqrt{3}\,a$ form the centre of a sphere of mass M just over the sphere (where a is the radius of the ring as well as that of the sphere). Then magnitude of gravitational force between them is

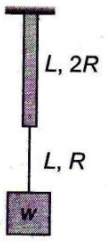


(a) $\frac{GMm}{8a^2}$ (b) $\frac{GMm}{\sqrt{3}a^2}$
(c) $\sqrt{3}\frac{GMm}{a^2}$ (d) $\sqrt{3}\frac{GMm}{8a^2}$

09. A metallic sphere floats in immiscible mixture of water (density $10^3\ kg/m^3$) and a liquid (density $8 \times 10^3\ kg/m^3$) such that its $\left(\frac{2}{3}\right)$ part is in water and $\left(\frac{1}{3}\right)$ part in the liquid. The density of the metal is

(a) $\frac{5000}{3}\ kg/m^3$ (b) $\frac{10000}{3}\ kg/m^3$
(c) $5000\ kg/m^3$ (d) $2000\ kg/m^3$

10. Two wires of the same material (Young's modulus = Y) and same length L but radii R and $2R$ respectively are joined end to end and a weight w is suspended from the combination as shown in the figure. The elastic potential energy in the system is



(a) $\frac{3w^2L}{4\pi R^2Y}$ (b) $\frac{3w^2L}{8\pi R^2Y}$
(c) $\frac{5w^2L}{8\pi R^2Y}$ (d) $\frac{w^2L}{\pi R^2Y}$

11. The speed of a homogeneous solid sphere after rolling down an inclined plane of vertical height h, from rest without sliding is

(a) $\sqrt{gh}$ (b) $\sqrt{\left(\frac{g}{5}\right)gh}$

(c) $\sqrt{\left(\frac{4}{3}\right)gh}$ (d) $\sqrt{\left(\frac{10}{7}\right)gh}$

12. The maximum acceleration of a particle in SHM is made two times keeping the maximum speed to be constant. It is possible when

(a) amplitude of oscillation is doubled while frequency remains constant

(b) amplitude is doubled while frequency is halved

(c) frequency is doubled while amplitude is halved

(d) frequency of oscillation is doubled while amplitude remains constant

13. A closed organ pipe and an open organ pipe of same length produce 2 beats when they are set into vibrations simultaneously in their fundamental mode. The length of open organ pipe is now halved and of closed organ pipe is doubled. The number of beats produced will be

(a) 8 (b) 7

(c) 4 (d) 2

14. Bimetal strips are used for

(a) metal thermometers

(b) opening of closing electrical circuits

(c) thermostats

(d) All of the above

15. The reading of air thermometer at 0°C and 100°C are 50 cm and 75 cm of mercury column respectively. The temperature at which its reading is 80 cm of mercury column is

(a) 105°C (b) 110°C

(c) 115°C (d) 120°C

16. Four molecules of a gas have speeds 1, 2, 3 and 4 km s^{-1}. The value of the root-mean-square speed of the gas molecules is

(a) $\frac{1}{2}\sqrt{15}\ \text{kms}^{-1}$ (b) $\frac{1}{2}\sqrt{10}\ \text{kms}^{-1}$

(c) 2.5 kms^{-1} (d) $\sqrt{15/2}\ \text{kms}^{-1}$

17. A vessel contains a mixture of one mole of oxygen and two moles of nitrogen at 300 K. The ratio of the average rotational kinetic energy per O_2 molecule to that per N_2 molecules is

(a) 1 : 1 (b) 1 : 2

(c) 2 : 1 (d) 8 : 7

18. The molar heat capacity in a process of a diatomic gas if it does a work of $\frac{Q}{4}$ when a heat of Q is supplied to it is

(a) $\frac{2}{5}R$ (b) $\frac{5}{2}R$

(c) $\frac{10}{3}R$ (d) $\frac{6}{7}R$

19. In an isothermal expansion of an ideal gas, select **wrong** statement

(a) there is no change in the temperature of the gas

(b) there is no change in the internal energy of the gas

(c) the work done by the gas is equal to the heat supplied to the gas

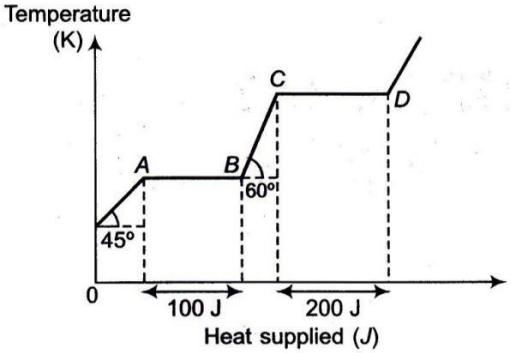
(d) the work done by the gas is equal to the change in its internal energy

20. A sphere, a cube and a thin circular palte are heated to the same temperature. All are made of the same material and have the equal masses. If t_1, t_2 and t_3 are the respective time taken by the sphere, cube and the circular plate in cooling down to a common temperature, then

(a) $t_1 > t_2 > t_3$ (b) $t_1 < t_2 < t_3$

(c) $t_2 > t_1 > t_3$ (d) $t_1 = t_2 = t_3$

21. The temperature change *versus* heat supplied curve is given for 1 kg of a solid block. Then, which of the following statement is/are correct?



(a) Specific heat capacity of the solid is 1 J/kg-K

(b) Specific heat capacity of liquid phase is $\sqrt{3}$ J/kg-K

(c) Latent heat of vaporization is 100 J/kg

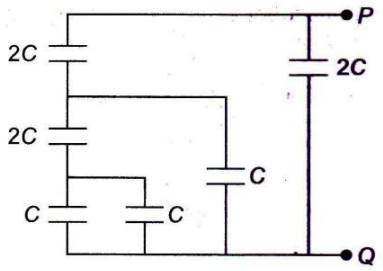
(d) Latent heat of vaporization is 200 J/kg

22. Rate of heat flow through a cylindrical rod is H_1. Temperatures of ends of rod are T_1 and T_2. If all the dimensions of rod become double and temperature difference remains same and rate of heat flow becomes H_2. Then

(a) $H_2 = 2H_1$ (b) $H_2 = H_1$

(c) $H_2 = \frac{H_1}{4}$ (d) $H_2 = 4H_1$

23. The resultant capacitance of given circuit between points P and Q is



(a) $3C$ (b) $2C$

(c) C (d) $\frac{C}{3}$

24. A particle having charge q and mass m is projected with velocity $\mathbf{v} = 2\hat{i} - 3\hat{j}$ in a uniform electric field $\mathbf{E} = E_0 \cdot \hat{j}$. Change in momentum $|\Delta \mathbf{p}|$ during any time interval t is given by

(a) $\sqrt{13}\, m$ (b) $qE_0 t$ (c) $\frac{qE_0 t}{m}$ (d) zero

25. A point charge is located at origin. At point (a, a), electric field is $\mathbf{E}_1$. At point $(-a, a)$ electric field is $\mathbf{E}_2$ and a point $(-a, -a)$ electric field is $\mathbf{E}_3$. The choose the correct option.

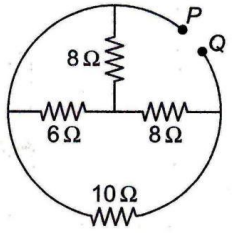
(a) $\mathbf{E}_1 \cdot \mathbf{E}_2 = 0$

(b) $|\mathbf{E}_1 \times \mathbf{E}_3| = 0$

(c) both are correct

(d) both are wrong

26. The equivalent resistance between P and Q in the figure is approximately



(a) 6 Ω (b) 5 Ω

(c) 7.5 Ω (d) 20 Ω

27. If potential $V = 100 \pm 0.5$ V and current $I = 10 \pm 0.2$ A are given to us. Then what will be the value of resistance?

(a) $10 \pm 0.7\ \Omega$ (b) $5 \pm 2\ \Omega$

(c) $0.1 \pm 0.2\ \Omega$ (d) None of these

28. The charge flowing in a conductor varies with time as $Q = at - bt^2$, then the current

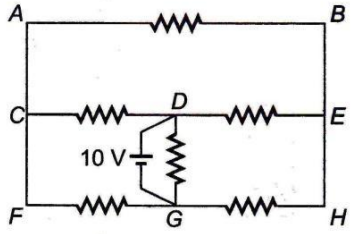
(a) reaches a maximum and then decreases

(b) falls to zero after $t = \frac{a}{2b}$

(c) changes at a rate of $(-2b)$

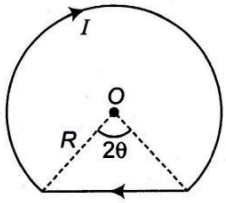
(d) Both (b) and (c)

29. All resistances shown in circuit are 2 Ω each. The current in the resistance between D and E is



(a) 5 A (b) 2.5 A (c) 1 A (d) 7.5 A

30. A current I flows through a closed loop shown in figure. The magnetic field at the centre O is



(a) $\frac{\mu_0 I}{2\pi R}(\pi - \theta + \tan\theta)$ (b) $\frac{\mu_0 I}{2\pi R}(\pi - \theta + \sin\theta)$

(c) $\frac{\mu_0 I}{2\pi R}(\theta + \sin\theta)$ (d) None of these

31. A rigid circular loop of radius r and mass m lies in the xy plane on a flat table and has a current i flowing in it. At this particular place the earth's magnetic field is $\mathbf{B} = B_x\hat{i} + B_z\hat{k}$. The value of i so that the loop starts tilting is

(a) $\frac{mg}{\pi r\sqrt{B_x^2 + B_z^2}}$ (b) $\frac{mg}{\pi r B_x}$

(c) $\frac{mg}{\pi r B_z}$ (d) $\frac{mg}{\pi r\sqrt{B_x B_z}}$

32. A paramagnetic liquid is filled in a glass U-tube of which one limb is placed between the pole pieces of an electromagnet. When the field is switched on the liquid in the limb which is in the field will

(a) rise (b) fall

(c) remain stationary (d) first rise and then fall

33. Ionization energy of a hydrogen-like ion A is greater than that of another hydrogen-like ion B. Let r, u, E and L represent the radius of the orbit, speed of the electron, energy of the atom and orbital angular momentum of the electron respectively. In ground state

(a) $r_A > r_B$ (b) $u_A > u_B$

(c) $E_A > E_B$ (d) $L_A > L_B$

34. The work function of a metal is 1 eV. Light of wavelength 3000 Å is incident on this metal surface. The velocity of emitted photoelectrons will be

(a) 10 m/s (b) 1×10^3 m/s

(c) 1×10^4 m/s (d) 1×10^6 m/s

35. A radioactive nucleus is being produced at a constant rate α per second. Its decay constant is λ. If N_0 are the number of nuclei at time $t = 0$, then maximum number of nuclei possible are

(a) $\frac{\alpha}{\lambda}$ (b) $N_0 + \frac{\alpha}{\lambda}$

(c) N_0 (d) $\frac{\lambda}{\alpha} + N_0$

36. A proton accelerated through a potential difference of 100V, has de-Broglie wavelength λ_0. The de-Broglie wavelength of an α-particle, accelerated through 800 V is

(a) $\frac{\lambda_0}{\sqrt{2}}$ (b) $\frac{\lambda_0}{2}$ (c) $\frac{\lambda_0}{4}$ (d) $\frac{\lambda_0}{8}$

37. In the reaction ${}_1^2H + {}_2^3H \rightarrow {}_2^4He + {}_0^1n$, if the binding energies per nucleon of ${}_1^2H$, ${}_1^3H$ and ${}_2^4He$, are x, y and z respectively. Then energy released in the process is

(a) $2x + 3y - 4z$ (b) $4z - 2x - 3y$

(c) $2x + 3y - 5z$ (d) None of these

38. The magnetic field at the centre of a hydrogen atom due to the motion of the electron in the first Bohr orbit is B. The magnetic field at the centre due to the motion of the electron in the second Bohr orbit will be

(a) $\frac{B}{4}$ (b) $\frac{B}{8}$

(c) $\frac{B}{32}$ (d) $\frac{B}{64}$

39. According to Moseley's law the ratio of the slope of graph between $\sqrt{f}$ and Z for K_β and K_α is

(a) $\sqrt{\frac{32}{27}}$ (b) $\sqrt{\frac{27}{32}}$

(c) $\sqrt{\frac{5}{36}}$ (d) $\sqrt{\frac{36}{5}}$

40. To observe diffraction, the size of an obstacle

(a) should be of the same order as wavelength

(b) should be much larger than the wavelength

(c) has no relation to wavelength

(d) should be exactly ($\lambda/2$)

41. Direction of the first secondary maximum in the Fraunhofer diffraction pattern at a single slit is given by (a is the width of the slit)

(a) $a \sin\theta = \frac{\lambda}{2}$ (b) $a \cos\theta = \frac{3\lambda}{2}$

(c) $a \sin\theta = \lambda$ (d) $a \sin\theta = \frac{3\lambda}{2}$

42. An interference is observed due to two coherent sources separated by a distance 5λ along y-axis, where λ is the wavelength of light. A detector D is moved along the positive x-axis. The number of point on the x-axis excluding the points $x = 0$ and $x = \infty$ at which resultant intensity will be maximum, are

(a) 4 (b) 5

(c) ∞ (d) zero

43. The focal lengths of the lenses of an astronomical telescope are 50 cm and 5 cm. The length of the telescope when the image is formed at the least distance of distinct vision is

(a) 45 cm (b) 55 cm

(c) $\frac{275}{6}$ cm (d) $\frac{325}{6}$ cm

44. A prism, having refractive index $\sqrt{2}$ and refracting angle 30°, has one of the refracting surfaces polished. A beam of light incident on the other refracting surface will trace its path, if the angle of incidence is

(a) 0° (b) 30°

(c) 45° (d) 60°

45. Three immiscible transparent liquids with refractive indices 3/2, 4/3 and 6/5 are arranged one on top of another. The depths of the liquids are 3 cm, 4 cm and 6 cm respectively. The apparent depth of the vessel is

(a) 10 cm (b) 9 cm

(c) 8 cm (d) 7 cm

SECTION 2 - CHEMISTRY

46. The angular momentum of the electron in first excited energy state of hydrogen atom is

(a) $\frac{h}{\pi}$ (b) $\frac{h}{2\pi}$

(c) $\sqrt{2(2+1)}\frac{h}{2\pi}$ (d) None of these

47. When NaCl is dopped with 1.0×10^{-3} mole of $SrCl_2$, the number of cation vacancy is

(a) 6.023×10^{18} (b) 6.023×10^{20}

(c) $2 \times 6.023 \times 10^{20}$ (d) 3.011×10^{20}

48. A 0.5 M NaOH solution offers a resistance of 31.6 ohm in a conductivity cell at room temperature. What shall be the approximate molar conductance of this NaOH solution if cell constant of the cell is 0.367 cm^{-1}.

(a) 23.4 S cm^2 $mole^{-1}$ (b) 23.2 S cm^2 $mole^{-1}$

(c) 46.45 S cm^2 $mole^{-1}$ (d) 54.64 S cm^2 $mole^{-1}$

49. Ammonium dichromate on heating gives

(a) chromic acid & ammonia

(b) chromium sesquioxide & nitrogen

(c) chromium sesquioxide & ammonia

(d) chromic acid and N_2

50. Predict the relative acidic strength among the following

(a) H_2O, H_2S, H_2Se, H_2Te

(b) $H_2O < H_2S < H_2Se < H_2Te$

(c) $H_2Te < H_2Se < H_2S < H_2O$

(d) $H_2O < H_2Se < H_2S < H_2Te$

51. The catalyst used in the preparation of an alkyl chloride by the action of dry HCl on an alcohol is

(a) anhydrous $AlCl_3$ (b) $FeCl_3$

(c) anhydrous $ZnCl_2$ (d) Cu

52. Among the following the aromatic compound is

(a) 

(b) 

(c)

(d) 

53. The four quantum numbers that could identify the third 3*p* electron in sulphur are

(a) $n=3, l=0, m=+1, s=+\frac{1}{2}$

(b) $n=2, l=2, m=-1, s=+\frac{1}{2}$

(c) $n=3, l=2, m=+1, s=-\frac{1}{2}$

(d) $n=3, l=1, m=-1, s=+\frac{1}{2}$

54. $Sn^{4+} + 2e^- \longrightarrow Sn^{2+}$ $E^\circ = 0.13$ V

$Br_2 + 2e^- \longrightarrow 2Br^-$ $E^\circ = 1.08$ V

Calculate K_{eq} for the cell at 20°C formed by two electrodes

(a) 10^{41} (b) 10^{32}

(c) 10^{-32} (d) 10^{-42}

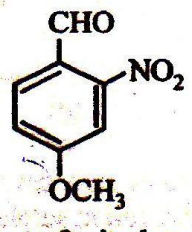
55. Calculate the pH of a solution obtained by mixing 2 ml of HCl of pH 2 and 3 ml of solution of KOH of pH = 12
(a) 10.30 (b) 3.70
(c) 11.30 (d) None of these

56. Which of the following represents a correct sequence of reducing power of the following elements?
(a) Li > Cs > Rb (b) Rb > Cs > Li
(c) Cs > Li > Rb (d) Li > Rb > Cs

57. Paramagnetism of Cr (Z = 24), Mn^{2+} (Z = 25) and Fe^{3+} (Z = 26) are x, y and z respectively. They are in the order
(a) $x = y = z$ (b) $x > y > z$
(c) $x = y > z$ (d) $x > y = z$

58. Formaldehyde reacts with ammonia to give urotropine is
(a) $(CH_2)_6N_4$ (b) $(CH_2)_4N_3$
(c) $(CH_2)_6N_6$ (d) $(CH_2)_3N_3$

59. The correct IUPAC name of the compound



is
(a) 4-methoxy-2-nitrobenzaldehyde
(b) 4-formyl -3 nitroanisole
(c) 4- methoxy-6-nitrobenzaldehyde
(d) 2-formyl-5-methoxynitrobenzene

60. The favourable condition for a process to be spontaneous is :
(a) $T\Delta S > \Delta H$, ΔH = +ive, ΔS = –ive
(b) $T\Delta S > \Delta H$, ΔH = +ive, ΔS = +ive
(c) $T\Delta S = \Delta H$, ΔH = –ive, ΔS = –ive
(d) $T\Delta S = \Delta H$, ΔH = +ive, ΔS = +ive

61. Vapour pressure (in torr) of an ideal solution of two liquids A and B is given by : $P = 52X_A + 114$ where X_A is the mole fraction of A in the mixture. The vapour pressure (in torr) of equimolar mixture of the two liquids will be :
(a) 166 (b) 83
(c) 140 (d) 280

62. What is order with respect to A, B, C, respectively

[A]	[B]	[C]	rate (M/sec.)
0.2	0.1	0.02	8.08×10^{-3}
0.1	0.2	0.02	2.01×10^{-3}
0.1	1.8	0.18	6.03×10^{-3}
0.2	0.1	0.08	6.464×10^{-2}

(a) –1, 1, 3/2 (b) –1, 1, 1/2
(c) 1, 3/2, –1 (d) 1, –1, 3/2

63. Fluorine does not show highest oxidation state opposite to other halogens, because
(a) it is most electronegative
(b) it has no d-orbital
(c) its atomic radius is very small
(d) F^- ion is stable and isoelectronic with neon

64. Glucose contains in addition to aldehyde group.
(a) one secondary –OH and four primary –OH groups
(b) one primary –OH and four secondary –OH groups
(c) two primary –OH and three secondary –OH groups
(d) three primary –OH and two secondary –OH groups

65. Which of the following product is obtained by treating 1-butyne with $HgSO_4$ and H_2SO_4?
(a) $CH_3CH_2COCH_3$
(b) $CH_3CH_2CH_2CHO$
(c) $CH_3CH_2CH_2COOH$
(d) $CH_3CH_2CH=CH_2$

66. Which of the following compound is expected to be optically active?
(a) $(CH_3)_2CHCHO$
(b) $CH_3CH_2CH_2CHO$
(c) $CH_3CH_2CHBrCHO$
(d) $CH_3CH_2CBr_2CHO$

67. The product obtained on reaction of C_2H_5Cl with hydrogen over palladium carbon is :
(a) C_3H_8 (b) C_4H_{10}
(c) C_2H_6 (d) C_2H_4

68. Which of the following can be predicted from electronegativity values of elements ?
(a) Dipole moment of a molecule
(b) Valency of elements
(c) Polarity of bonds
(d) Position in electrochemical series

69. The reaction
$3ClO^-_{(aq)} \longrightarrow ClO^-_{3(aq)} + 2Cl^-_{(aq)}$ is an example of
(a) oxidation reaction
(b) reduction reaction
(c) disproportionation reaction
(d) decomposition reaction

70. The concentration of a reactant X decreases from 0.1 M to 0.005 M in 40 min. If the reaction follows first order kinetics, the rate of the reaction when the concentration of X is 0.01 M will be
(a) 1.73×10^{-4} M min^{-1}
(b) 3.47×10^{-4} M min^{-1}
(c) 3.47×10^{-5} M min^{-1}
(d) 7.5×10^{-4} M min^{-1}

71. Mark the false statement?
(a) A salt bridge is used to eliminate liquid junction potential
(b) The Gibbs free energy change, ΔG is related with electromotive force E as $\Delta G = -nFE$
(c) Nernst equation for single electrode potential is $E = E^\circ - \frac{RT}{nF}\log a_{M^{n+}}$
(d) The efficiency of a hydrogen-oxygen fuel cell is 23%

72. The paramagnetism of transition element compounds is due to
(a) paired eletrons spining in opposite directions
(b) unpaired eletrons in *d* and *f*-orbitals
(c) shared valance electrons
(d) unpaired electrons in *s* or *p*-orbitals.

73. Aniline, chloroform and alcoholic KOH react to produce a bad smelling substance which is
(a) phenyl isocyanide
(b) phenyl cyanide
(c) chlorobenzene
(d) benzyl alcohol.

74. The species with a radius less than that of Ne is
(a) Mg^{2+} (b) F^-
(c) O^{2-} (d) K^+

75. Vapour density of the equilibrium mixture of the reaction $SO_2Cl_{2(g)} \rightleftharpoons SO_{2(g)} + Cl_{2(g)}$ is 50.0. Percent dissociation of SO_2Cl_2 is :
(a) 33.33 (b) 35.0
(c) 30.0 (d) 66.67

76. The chemical reaction,
$2AgCl_{(s)} + H_{2(g)} \longrightarrow 2HCl_{(aq)} + 2Ag(s)$
taking place in a galvanic cell is represented by the notation
(a) $Pt_{(s)} | H_{2(g)}, 1\text{ bar} | 1M\,KCl_{(aq)} | AgCl_{(s)} | Ag_{(s)}$
(b) $Pt_{(s)} | H_{2(g)}, 1\text{ bar} | 1M\,HCl_{(aq)} | 1MAg^+_{(aq)} | Ag_{(s)}$
(c) $Pt_{(s)} | H_{2(g)}, 1\text{ bar} | 1M\,HCl_{(aq)} | AgCl_{(s)} | Ag_{(s)}$
(d) $Pt_{(s)} | H_{2(g)}, 1\text{ bar} | 1M\,HCl_{(aq)} | Ag_{(s)} | AgCl_{(s)}$

77. H_3PO_3 is
(a) neutral (b) basic
(c) a tribasic acid (d) a dibasic acid

78. Of the following which is diamagnetic in nature?
(a) $[Co\,F_6]^{3+}$ (b) $[Ni\,Cl_4]^{2-}$
(c) $[Cu\,Cl_4]^{2-}$ (d) $[Ni(CN)_4]^{2-}$

79. Which of the following products is formed when benzaldehyde is treated with CH_3MgBr and the addition product so obtained is subjected to acid hydrolysis ?
(a) A secondary alcohol
(b) A primary alcohol
(c) Phenol
(d) tert-Butyl alcohol

80. Mole fraction of methanol in its aqueous solution is 0.5. The concentration of solution in terms of percent by mass of methanol is
(a) 36 (b) 50
(c) 64 (d) 72

81. The unit cell of an ionic compound is a cube in which cations (*A*) occupy each of the corners and anions (*B*) are at the centres of each face . The simplest formula of the ionic compound is
(a) AB_2 (b) A_3B
(c) AB_3 (d) A_4B_3

82. Select the process that represents smelting.

(a) $2Al_2O_3 + 6H_2O \xrightarrow{\Delta} 4Al(OH)_3$

(b) $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

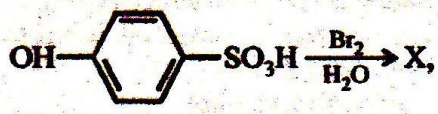
(c) $Fe_2O_3 + 3C \xrightarrow{\Delta} 2Fe + 3CO$

(d) $2Pb + O_2 \xrightarrow{\Delta} 2PbO + 2SO_2$

83. Electrolytic reduction of alumina to aluminium by Hall- Heroult process is carried out
(a) in the presence of NaCl
(b) in the presence of fluorite
(c) in the presence of cryolite which forms a melt with lower melting temperature
(d) in the presence of cryolite which forms a melt with higher melting temperature

84. Complexes $[Co(NH_3)_5SO_4]$ Br and $[Co(NH_3)_5Br]SO_4$ can be distinguished by
(a) conductance measurement
(b) using $BaCl_2$
(c) using $AgNO_3$
(d) both b and c

85. Nylon is a :
(a) polysaccharide (b) polyester
(c) polyamide (d) all of the above

86. 

X is identified as
(a) 2, 4, 6-tribromophenol
(b) 2-bromo-4-hydroxylbenzene sulphonic acid
(c) 3, 5-dibromo-4-hydroxybenzene sulphonic acid
(d) 2-bromophenol

87. The non-polar molecule is :
(a) NF_3 (b) SO_3
(c) $CHCl_3$ (d) ClO_2

88. The hybridization of P in PO_4^{3-} is the same as of
(a) S in SO_3 (b) N in NO^-_3
(c) S in SO_4^{--} (d) I in ICl_4^-

89. Solution of potash alum is acidic in nature. This is due to hydrolysis of
(a) SO_4^{2-} (b) K^+
(c) $Al_2(SO_4)_3$ (d) Al^{3+}

90. When conc. HNO_3 acts on our skin, the skin becomes yellow, because
(a) HNO_3 acts as an oxidising agent
(b) HNO_3 acts as a dehydrating agent
(c) Nitro-cellulose is formed
(d) The proteins are converted into xanthoproteins

SECTION 3 - BOTANY

91. Basic unit of taxonomy is
(a) Genus (b) Species
(c) Family (d) Order

92. Which one of the following is a living fossil?
(a) *Pinus* (b) *Opuntia*
(c) *Ginkgo* (d) *Thuja*

93. Alginates (alginin), used as highly efficient gauze in internal operations are obtained from cell walls of
(a) Cyanophyceae (b) Phaeophyceae
(c) Rhodophyceae (d) All of these

94. Bryophytes resemble algae in the following aspects
(a) Filamentous body, presence of vascular tissues and autotrophic nutrition
(b) Differentiation of plant body into root, stem and leaves and autotrophic nutrition
(c) Thallus like plant body, presence of root and autotrophic nutrition
(d) Thallus like plant body, lack of vascular tissues and autotrophic nutrition

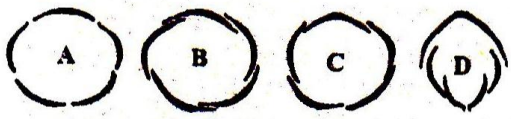
95. Clove is
(a) flower bud (b) axillary bud
(c) thalamus (d) ovule

96. When gynoecium is present in the top most position of thalamus, the flower is known as
(a) inferior (b) epigynous
(c) perigynous (d) hypogynous

97. Which is not a stem modification ?
(a) Rhizome of ginger
(b) Corm of *Colocasia*
(c) Pitcher of *Nepenthes*
(d) Tuber of potato

98. In land plants, the guard cells differ from other epidermal cells in having
(a) cytoskeleton
(b) mitochondria
(c) endoplasmic reticulum
(d) chloroplasts

99. Which option is correctly matched with the diagrams?

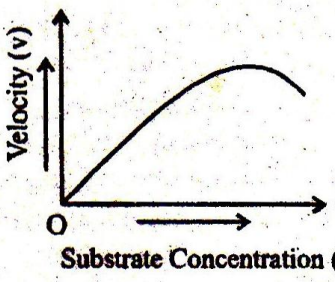


(a) A-Valvate B-Twisted, C-Imbricate, D-Vexillary
(b) A-Vexillary, B-Valvate, C-Twisted, D-Imbricate
(c) A-Imbricate, B-Vexillary, C-Valvate, D-Twisted
(d) A-Twisted, B-Imbricate, C-Vexillary, D-Valvate

100. Most abundant lipid in the cell membrane is
(a) cholesterol (b) phospholipids
(b) glycolipids (d) cerebrosides

101. Histones are
(a) glycoproteins (b) mucoproteins
(c) basic proteins (d) acid proteins

102. The given graph shows the effect of substrate concentration on the rate of reaction of the enzyme green -gram -phosphatase. What does the graph indicate ?



(a) The rate of enzyme reaction is directly proportional to the substrate concentration
(b) Presence of an enzyme inhibitor in the reaction mixture
(c) Formation of an enzyme-substrate complex
(d) At higher substrate-concentration the pH increases.

103. The Km value of the enzyme is the value of the substrate concentration at which the reaction reaches to
(a) Zero (b) 2Vmax
(c) ½Vmax (d) ¼Vmax

104. A plant cell placed in pure water will
(a) expand until the osmotic potential or solute potential reaches that of water.
(b) becomes more turgid until the pressure potential of cell reaches its osmotic potential.
(c) become more turgid until the osmotic potential reaches that of pure water.
(d) becomes less turgid until the osmotic potential reaches that of pure water.

105. During cell division, sometimes there will be failure of separation of sister chromatids. This event is called
(a) interference (b) complementation
(c) non-disjunction (d) coincidence

106. In which stage of the cell cycle histone proteins synthesized in a eukaryotic cell?
(a) During G_2 stage of prophase
(b) During S-phase
(c) During entire prophase
(d) During telophase

107. Which of the following is not a correct pairing of a macronutrient and the major functions it performs in the life of a plant ?
(a) Potassium-enzyme activation, water balance, ion balance.
(b) Calcium-activity of membranes and cytoskeleton, second messenger.
(c) Sulphur-in proteins and coenzymes.
(d) Iron-in active sites of many redox enzymes and electron carriers.

108. Which of the following statement is false?
(a) H_2S, not H_2O, is involved in photosynthesis of purple sulphur bacteria.
(b) Light and dark reactions are stopped in the absence of light.
(c) Calvin cycle occurs in the grana of chloroplast.
(d) ATP is produced during light reaction *via* chemiosmosis.

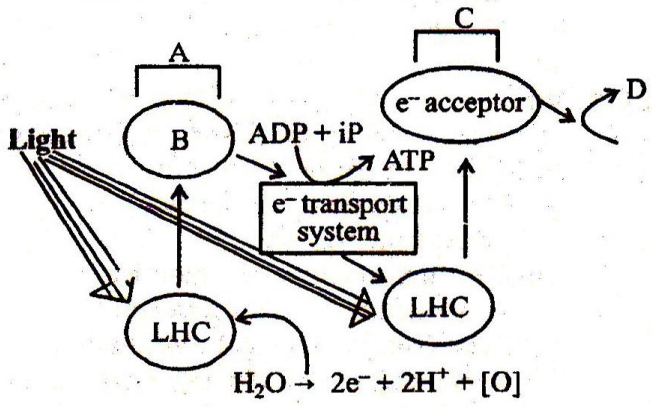
109. The casparian strip prevents water and minerals from entering the stele through the
(a) plasmodesmata (b) apoplast
(c) symplast (d) xylem vessel

110. 'Whip-tail' disease in cauliflower is due to deficiency of
(a) manganese (b) magnesium
(c) molybdenum (d) nitrogen

111. R.Q. is highest when respiratory substance is
(a) fat (b) malic acid
(c) glucose (d) protein

112. Electron transport chain is inhibited by
(a) rotenone and amytal
(b) antimycin-A
(c) cyanide (CN^-), azide (N^{3-}) and carbon monoxide (CO)
(d) All of the above

113. Given below is the pathway of light reaction. Identify the given blanks indicated by A, B, C, D and E.



	A	B	C	D
(a)	P 700	H^+ acceptor	P680	$NADP^+$
(b)	Photosystem I	e^- acceptor	Photosystem II	$NADPH_2$ + ATP
(c)	Photosystem II	H^+ acceptor	P700	NADPH
(d)	Photosystem II	e^- acceptor	Photosystem I	NADPH + H^+

114. In tissue culture roots can be induced by
(a) no cytokinin and only auxins.
(b) higher concentration cytokinin and lower concentration auxins.
(c) lower concentration of cytokinin and higher concentration of auxins.
(d) only cytokinin and no auxins.

115. Phytohormones are
(a) chemicals regulating flowering.
(b) chemicals regulating secondary growth.
(c) hormones regulating growth from seed to adulthood.
(d) regulators synthesized by plants and influencing physiological processes.

116. Which one of the following is a natural growth inhibitor?
(a) NAA (b) ABA
(c) IAA (d) GA

117. The disadvantage of parthenogenesis is –
(a) Establishment of polyploid generation
(b) Elimination of variety in population
(c) Means of reproduction
(d) Does not encourage the appearance of new and advantageous combinations of genes

118. Unisexuality of flowers prevents
(a) autogamy, but not geitonogamy
(b) both geitonogamy and xenogamy
(c) geitonogamy, but not xenogamy
(d) autogamy and geitonogamy

119. One of the important consequences of geographical isolation is
(a) preventing speciation
(b) speciation through reproductive isolation
(c) random creation of new species
(d) no change in the isolated fauna.

120. Genetic drift operates only in
(a) smaller populations
(b) larger populations
(c) mendelian populations
(d) island populations

121. Three crops that contribute maximum to global food grain production are
(a) Wheat, rice and maize
(b) Wheat, rice and barley
(c) Wheat, maize and sorghum
(d) Rice, maize and sorghum

122. Farmers have reported over 50% higher yields of rice by using the biofertilizer
(a) *Azolla pinnata*
(b) *Cyanobacteria*
(c) *Legume-Rhizobium* symbiosis
(d) Mycorrhiza

123. Himgiri developed by hybridisation and selection for disease resistance against rust pathogens is a variety of
(a) chilli (b) maize
(c) sugarcane (d) wheat

124. Which one of the following is not used for construction of ecological pyramids ?
(a) Number of individuals
(b) Rate of energy flow
(c) Fresh weight
(d) Dry weight

125. In agarose gel electrophoresis
(a) DNA migrates towards the negative electrode
(b) supercoiled plamids migrate slower than their nicked counterparts
(c) larger molecules migrate faster than smaller molecules
(d) ethidium bromide can be used to visualize the DNA

126. The genetically-modified (GM) brinjal in India has been developed for:
(a) insect-resistance
(b) enhancing shelf life
(c) enhancing mineral content
(d) drought-resistance

127. Which one of the following is not observed in biodiversity hotspots ?
(a) Endemism
(b) Accelerated species loss
(c) Lesser inter-specific competition
(d) Species richness

128. Which one of the following expanded forms of the following acronyms is correct?
(a) IPCC = International Panel for Climate Change
(b) UNEP = United Nations Environmental Policy
(c) EPA = Environmental Pollution Agency
(d) IUCN = International Union for Conservation of Nature and Natural Resources

129. Photochemical smog pollution does not contain
(a) Nitrogen dioxide
(b) Carbon dioxide
(c) PAN (peroxy acetyl nitrate)
(d) Ozone

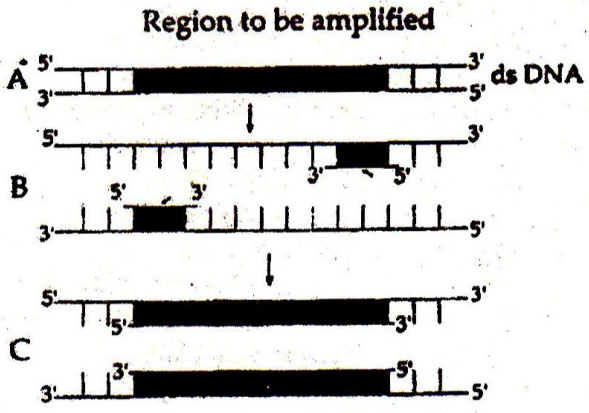
130. When huge amount of sewage is dumped into a river, its B.O.D. will
(a) increase (b) decrease
(c) sharply decrease (d) remain unchanged

131. Which one of the following shows maximum genetic diversity in India ?
(a) Groundnut (b) Rice
(c) Maize (d) Mango

132. The greatest biomass of autotrophs in the oceans is that of
(a) sea grasses and slime moulds
(b) free floating microalgae, cyanobacteria and nanoplankton
(c) benthic brown algae,coastal red algae and daphnids
(d) benthic diatoms and marine viruses

133. Which of the following is based upon the principle of antigen-antibody interaction?
(a) PCR (b) ELISA
(c) R DNA technology (d) RNA

134. The figure below shows three steps (A, B, C) of Polymerase Chain Reaction (PCR). Select the option giving correct identification together with what it represents?



(a) B - Denaturation at a temperature of about 98°C separating the two DNA strands.
(b) A - Denaturation at a temperature of about 50°C.
(c) C - Extension in the presence of heat stable DNA polymerase.
(d) A - Annealing with two sets of primers.

135. Which of the following statement(s) is/are true?
(i) Uneven thickening of cell wall is characteristic of sclerenchyma.
(ii) Periblem forms cortex of the stem and the root.
(iii) Tracheids are the chief water transporting elements in gymnosperms.
(iv) Companion cell is devoid of nucleus at maturity.
(v) The Commercial cork is obtained from *Quercus suber.*
(a) (i) and (iv) only (b) (ii) and (v) only
(c) (iii) and (iv) only (d) (ii), (iii) and (v) only

SECTION 4 - ZOOLOGY

136. In prokaryotes, the genetic material is
(a) linear DNA with histones
(b) circular DNA with histones
(c) linear DNA without histones
(d) circular DNA without histones

137. In *Amoeba* and *Paramecium* osmoregulation occurs through
(a) pseudopodia (b) nucleus
(c) contractile vacuole (d) general surface

138. Animals with metameric segmentation, bilateral symmetry and closed circulatory system belong to phylum
(a) Annelida (b) Echinodermata
(c) Arthropoda (d) Mollusca

139. Which one of the following characters is not typical of the class Mammalia?
(a) Thecodont dentition
(b) Alveolar lungs
(c) Ten pairs of cranial nerves
(d) Seven cervical vertebrae

140. Which of the following type of cell junction is not found in animal tissues ?
(a) Desmosome (b) Tight junction
(c) Gap junction (d) Plasmodesmata

141. Which one of the following cellular components of the blood is responsible for the production of antibodies?
(a) Thrombocyte (b) Lymphocyte
(c) Monocyte (d) Erythrocyte

142. Sprain is caused due to the excessive pulling of
(a) Muscles (b) Tendons
(c) Ligaments (d) All of the above

143. Which one of the following pairs of the kind of cells and their secretion is correctly matched?
(a) Oxyntic cells—a secretion with pH between 2.0 and 3.0
(b) Alpha cells of islets of Langerhans—secretion that decreases blood sugar level
(c) Kupffer cell—a digestive enzyme that hydrolyses nucleic acids
(d) Sebaceous glands—a secretion that evaporates for cooling

144. In cockroach, the corpora allata is
(a) A sense organ
(b) A tactile organ
(c) An endocrine organ
(d) A digestive gland

145. Which group contains biocatalysts?
(a) Myosin, oxytocin, adrenalin
(b) Peptidase, amylase, rennin
(c) Glucose, amino acids, fatty acids
(d) Rhodopsin, pepsin, steapsin

146. Both the crown and root of a tooth is covered by a layer of bony hard substance. It is called
(a) enamel (b) dentine
(c) bony socket (d) cementum

147. The respiratory centre, which regulates respiration, is located in
(a) Cerebral peduncle
(b) Vagus nerve
(c) Pons
(d) Medulla oblongata

148. Even when there is no air in it, human trachea does not collapse due to presence of
(a) Bony rings (b) Turgid pressure
(c) Chitinous rings (d) Cartilaginous rings

149. The structure which does not contribute to the breathing movements in mammals is
(a) Larynx (b) Ribs
(c) Diaphragm (d) Intercostal muscles

150. Find out the incorrect answer from the following?
(a) Veins are typically larger in diameter than arteries
(b) Because of their small size, capillaries contain blood that is moving more quickly than in other parts of the circulatory system
(c) The walls of arteries are elastic, enabling them to stretch and shrink during changes in blood pressure
(d) Veins contain more blood than any other part of the circulatory system

151. Given below are four statements (i-iv) regarding human blood circulatory system
(i) Arteries are thick-walled and have narrow lumen as compared to veins
(ii) Angina is acute chest pain when the blood circulation to the brain is reduced
(iii) Persons with blood group AB can donate blood to any person with any blood group under ABO system
(iv) Calcium ions play a very important role in blood clotting
Which two of the above statements are correct?
(a) (i) and (iv) (b) (i) and (iv)
(c) (ii) and (iii) (d) (iii) and (iv)

152. In Prawn, excretion is carried out by
(a) Nephrons (b) Malpighian tubules
(c) Flame cells (d) Green glands

153. Columns of Bertini in the kidneys of mammals are formed as extensions of
(a) Cortex into medulla
(b) Cortex into pelvis
(c) Medulla into pelvis
(d) Pelvis into ureter

154. Consider the following four statements (i - iv) about certain desert animals such as kangaroo rat
(i) They have dark colour and high rate of reproduction and excrete solid urine
(ii) They do not drink water, breathe at a slow rate to conserve water and have their body covered with thick hairs
(iii) They feed on dry seeds and do not require drinking water
(iv) They excrete very concentrated urine and do not use water to regulate body temperature.
Which two of the above statements for such animals are true?
(a) (i) and (ii) (b) (iii) and (iv)
(c) (ii) and (iii) (d) (iii) and (i)

155. Which of the following is an autoimmune disorder ?
(a) Myasthenia gravis (b) Osteoporosis
(c) Muscular dystrophy (d) Gout

156. Thin filaments of skeletal muscle fibres contain
(a) Actin protein only
(b) Actin and myosin proteins
(c) Actin, Troponin and Tropomyosin proteins
(d) Actin, Troponin, Myosin and Tropomyosin proteins

157. The joint in our neck which allows us to rotate our head left to right is
(a) pivot joint (b) hinge joint
(c) saddle joint (d) ellipsoid joint

158. Among which one of the following groups of chemicals, all are neurotransmitters?
(a) Glycine, dopamine, melatonin
(b) Somatostatin, serotonin, acetylcholine
(c) Noradrenaline, somatostatin, threonine
(d) Acetylcholine, nbradrenaline, dopamine

159. The enzyme required for the conduction of nerve impulse across synapse is:
(a) peroxidase
(b) choline acetylase
(c) ascorbic acid oxidase
(d) succinic dehydrogenase

160. The purplish red pigment rhodopsin contained in the rods type of photoreceptor cells of the human eye, is a derivative of
(a) Vitamin A (b) Vitamin B_1
(c) Vitamin C (d) Vitamin D

161. Which hormone interacts with membrane bound receptor and does not normally enter the target cell ?
(a) Follicle stimulating hormone
(b) Estrogen
(c) Thyroxin
(d) Cortisol

162. The 24 hour (diurnal) rhythm of our body such as the sleep-wake cycle is regulated by the hormone
(a) Adrenaline (b) Melatonin
(c) Calcitonin (d) Prolactin

163. Steroid hormones transmit their information by
(a) stimulating the receptors present on cell membrance
(b) entering into the cell and modifying cellular contents
(c) entering into the cell and modifying nuclear organization
(d) the help of an intracellular second messenger

164. During regeneration, modification of an organ to other organ is known as
(a) Morphogenesis (b) Epimorphosis
(c) Morphallaxis (d) Accretionary growth

165. In oogamy, fertilization involves
(a) a small non-motile female gamete and a large motile male gamete
(b) a large non-motile female gamete and a small motile male gamete
(c) a large non-motile female gamete and a small non motile male gamete
(d) a large motile female gamete and a small nonmotile male gamete

166. The part of fallopian tube closest to the ovary is
(a) isthmus (b) infundibulum
(c) cervix (d) ampulla

167. Correct sequence of cell stages in spermatogenesis is:
(a) spermatocytes, spermatids, spermatogonia, spermatozoa
(b) spermatogonia, spermatocytes, spermatids, spermatozoa
(c) spermatocytes, spermatogonia, spermatids, spermatozoa
(d) spermatogonia, spermatids, spermatocytes, spermatozoa

168. Progestasert and LNG-20 are
(a) Implants
(b) Copper releasing IUDs
(c) Non-medicated IUDs
(d) Hormone releasing IUDs

169. Which one of the following conditions correctly describes the manner of determining the sex in the given example?
(a) Homozygous sex chromosomes (ZZ) determine female sex in birds.
(b) XO type of sex chromosomes determine male sex in grasshopper.
(c) XO condition in human as found in Turner syndrome, determines female sex.
(d) Homozygous sex chromosomes (XX) produce male in *Drosophila.*

170. Select the correct statement from the ones given below with respect to dihybrid cross.
(a) Tightly linked genes on the same chromosome show higher recombinations
(b) Genes far apart on the same chromosome show very few recombinations
(c) Genes loosely linked on the same chromosome show similar recombinations as the tightly linked ones
(d) Tightly linked genes on the same chromosome show very few recombinations

171. One gene-one enzyme relationship was established for the first time in
(a) *Salmonella typhimurium*
(b) *Escherichia coli*
(c) *Diplocococcus pneumoniae*
(d) *Neurospora crassa.*

172. The transforming principle of *Pneumococcus* as found out by Avery, MacLeod and McCarty was
(a) mRNA (b) DNA
(c) protein (d) polysaccharide

173. In emphysema –
(a) Gas exchange area of lungs is reduced
(b) Gas exchange area of lungs is increased
(c) Trachea gets narrowed
(d) Larynx is permanently closed

174. Damage to thymus in a child may lead to –
(a) a reduction in haemoglobin content of blood
(b) a reduction in stem cell production
(c) loss of antibody mediated immunity
(d) loss of cell mediated immunity

175. Two microbes found to be very useful in genetic engineering are
(a) *Vibrio cholerae* and a tailed bacteriophage
(b) *Diplococcus* sp. and *Pseudomonas* sp.
(c) Crown gall bacterium and *Caenorhabditis elegans*
(d) *Escherichia coli* and *Agrobacterium tumefaciens*

176. An "Urn" shaped population age pyramid represents
(a) Growing population
(b) Static population
(c) Declining population
(d) Threatenped population

177. Study the four statements (i–iv) given below and select the two correct ones out of them:
(i) A lion eating a deer and a sparrow feeding on grain are ecologically similar in being consumers
(ii) Predator star fish *Pisaster* helps in maintaining species diversity of some invertebrates
(iii) Predators ultimately lead to the extinction of prey species
(iv) Production of chemicals such as nicotine, strychnine by the plants are metabolic disorders

The two correct statements are:
(a) (ii) and (iii) (b) (iii) and (iv)
(c) (i) and (iv) (d) (i) and (ii)

178. Reason of diversity in living beings is due to
(a) mutation
(b) long term evolutionary change
(c) gradual change
(d) short term evolutionary change

179. Part of alimentary canal meant for reabsorption of the maximum H_2O is
(a) Small intestine (b) large intestine
(c) rectum (d) colon

180. Which one of the following pairs of structures is correctly matched with their correct description ?

	Structures	Description
(a)	Tibia and fibula	Both form parts of knee joint
(b)	Cartilage and cornea	No blood supply but do require oxygen for respiratory need
(c)	Shoulder joint and elbow joint	Ball and socket type of joint
(d)	Premolars and molars	20 in all and 3– rooted