01. The dimensions of magnetic field in M, L, T and C (coulomb) is given as
(a) $[MLT^{-1}C^{-1}]$ (b) $[MT^2C^{-2}]$
(c) $[MT^{-1}C^{-1}]$ (d) $[MT^{-2}C^{-1}]$

02. According to Einstein's photoelectric equation, the plot of the kinetic energy of the emitted photoelectrons from a metal vs the frequency of the incident radiation gives a straight line whose slope
(a) depends on the intensity of the radiation
(b) depends of the mature of the metal used
(c) depends both on the intensity of the radiation and the metal used
(d) is the same for all metals and independent of the intensity of the radiation

03. A tin nucleus (atomic number $Z = 50$) has a radius of 6.6×10^{-15} m. The potential on its surface will be (the charge on the proton = 1.6×10^{-19} C)
(a) 1.1×10^7 V (b) 2.1×10^7 V
(c) 3.1×10^7 V (d) 0.15×10^7 V

04. Two rods of the same length and areas of cross-section A_1 and A_2 have their ends at the same temperature K_1 and K_2 are the thremal conductivities of the two rods. The rate of flow of heat is same in both rods if
(a) $\frac{A_1}{A_2} = \frac{K_1}{K_2}$ (b) $\frac{A_1}{A_2} = \frac{K_2}{K_1}$
(c) $A_1A_2 = K_1K_2$ (d) $A_1K_1^2 = A_2K_2^2$

05. Ability of the eye to see objects at all distances is called
(a) binocular vision (b) myopia
(c) hypermetropia (d) accommodation

06. The velocity of electromagnetic radiation in a medium of permittivity ϵ_0 and permeability μ_0 is given by
(a) $\sqrt{\frac{\epsilon_0}{\mu_0}}$ (b) $\sqrt{\mu_0 \epsilon_0}$
(c) $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$ (d) $\sqrt{\frac{\mu_0}{\epsilon_0}}$

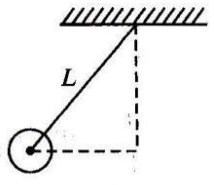
07. Pressure exerted by a perfect gas is equal to
(a) mean kinetic energy per unit volume
(b) half of mean kinetic energy per unti volume
(c) two third of mean kinetic energy per unit volume
(d) one third of mean kinetic energy per unit volume

08. A spherical ball of iron of radius 2 mm is falling through a column of glycerine. If densities of glycerine and iron are respectively 1.3×10^3 kg/m^3 and 8×10^3 kg/m^3, η for glycerine = 0.83 Nm^{-2} sec, then the terminal velocity is
(a) 0.7 m/s (b) 0.07 m/s
(c) 0.007 m/s (d) 0.0007 m/s

09. The relation between the coefficient of real expansion (γ_r) and coefficient of apparent expansion(γ_a) of a liquid and the coefficient of linear expansion (α_g) of the material of the container is
(a) $\gamma_r = \alpha_g + \gamma_a$ (b) $\gamma_r = \alpha_g + 3\gamma_a$
(c) $\gamma_r = 3\alpha_g + \gamma_a$ (d) $\gamma_r = 3(\alpha_g + \gamma_a)$

10. At a given instant of time two particles are having the position vectors $4\hat{i} - 4\hat{j} + 7\hat{k}$ metres and $2\hat{i} + 2\hat{j} + 5\hat{k}$ metres, respectively. If the velocity of the first particle be $0.4\hat{i}$ m s^{-1}, the velocity of second particle in metre per second, if they collide after 10 sec, is :
(a) $6\left(\hat{i} - \hat{j} + \frac{1}{3}\hat{k}\right)$ (b) $0.6\left(\hat{i} - \hat{j} + \frac{1}{3}\hat{k}\right)$
(b) $6\left(\hat{i} + \hat{j} + \frac{1}{3}\hat{k}\right)$ (d) $0.6\left(\hat{i} + \hat{j} - \frac{1}{3}\hat{k}\right)$

11. A ball of mass (m) 0.5 kg is attached to the end of a string having length (L) 0.5 m. The ball is rotated on a horizontal circular path above vertical axis. The maximum tension the string can bear is 324 N. The maximum possible value of angular velocity of ball (in radian/s) is



(a) 9 (b) 18
(c) 27 (d) 36

12. Two wires of same material and same diameter have lengths in the ratio 2 : 5. They are stretched by same force. The ratio of work done in stretching them is
(a) 5 : 2 (b) 2 : 5
(c) 1 : 3 (d) 3 : 1

13. A large open tank has two holes in the wall. One is a square hole of side L at a depth y from the top and the other is a circular hole of radius R at a depth $4y$ from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then, R is equal to

(a) $\frac{L}{\sqrt{2\pi}}$ (b) $2\pi L$

(c) L (d) $\frac{L}{2\pi}$

14. A water barrel having water up to a depth d is placed on a table of height h. A small hole is made on the wall of the barrel at its bottom. If the stream of water coming out of the hole falls on the ground at a horizontal distance R from the barrel, then the value of d is

(a) $\frac{4h}{R^2}$ (b) $4hR^2$

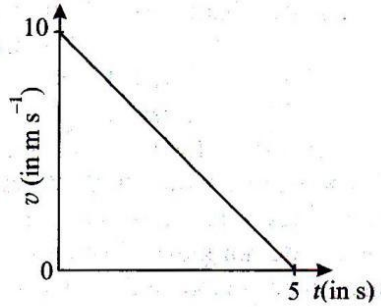
(c) $\frac{R^2}{4h}$ (b) $\frac{h}{4R^2}$

15. A flat plate moves normally with a speed v_1 towards a horizontal jet of water of uniform area of cross section. The jet discharges water at the rate of volume V per second at a speed of v_2. The density of water is ρ. Assume that water splashes along the surface of the plate at right angles to the original motion. The magnitude of the force acting on the plate due to the jet of water is

(a) $\rho V v_1$ (b) $\rho\left(\frac{V}{v_2}\right)(v_1+v_2)^2$

(c) $\frac{\rho V}{v_1+v_2}v_1^2$ (d) $\rho V(v_1+v_2)$

16. A block of mass 1 kg is given a push horizontally so that it starts sliding on a rough horizontal plane. The velocity -time graph of the motion is shown. The coefficient of sliding friction between the plane and the block is ($g = 10$ m/s^2)



(a) 0.4 (b) 0.2

(c) 0.04 (d) 0.02

17. Two particles of equal mass m go around a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle with respect to their centre of mass is

(a) $\sqrt{\frac{Gm}{4R}}$ (b) $\sqrt{\frac{Gm}{3R}}$

(c) $\sqrt{\frac{GM}{2R}}$ (d) $\sqrt{\frac{GM}{R}}$

18. A satellite is moving with a constant speed V in a circular orbit about the earth. An object of mass m is ejected from the satelite such that it just escapes from the gravitational pull of the earth. At the time of its ejection, the kinetic energy of the object is

(a) $\frac{1}{2}mV^2$ (b) mV^2

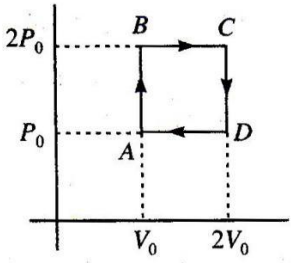
(c) $\frac{3}{2}mV^2$ (d) $2mV^2$.

19. 5.6 litre of helium gas at STP is adiabatically compressed to 0.7 litre. Taking the initial temperature to be T_1, the work done in the process is

(a) $\frac{9}{8}RT_1$ (b) $\frac{3}{2}RT_1$

(c) $\frac{15}{8}RT_1$ (d) $\frac{9}{2}RT_1$

20. Helium gas goes through a cycle $ABCDA$ (consisting of *two* isochoric and two isobaric lines) as shown in figure. Efficiency of this cycle is nearly: (Assume the gas to be close to ideal gas)



(a) 15.4% (b) 9.1%

(c) 10.5% (d) 12.5%

21. Three very large plates of same area are kept parallel and close to each other. They are considered as ideal black surfaces and have very high thermal conductivity. The first and the third plates are maintained at temperatures $2T$ and $3T$, respectively. The temperature of the middle (i.e., second) plate under steady state condition is

(a) $\left(\frac{65}{2}\right)^{\frac{1}{4}} T$ (b) $\left(\frac{97}{4}\right)^{\frac{1}{4}} T$

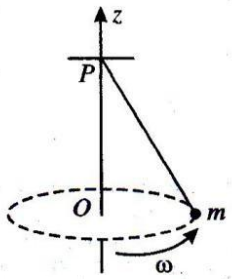
(c) $\left(\frac{97}{2}\right)^{\frac{1}{4}} T$ (d) $(97)^{\frac{1}{4}} T$

22. A particle is projected from the ground. If the equation of the trajectory is $y = x - x^2/2$, then the time of flight is

(a) $2/\sqrt{g}$ (b) $3/\sqrt{g}$

(c) $4/\sqrt{g}$ (d) $2\sqrt{2/g}$

23. A small mass m is attached to a massless string whose other end is fixed at P as shown in the figure. The mass is undergoing circular motion in the x-y plane with centre at O and constant angular speed ω. If the angular momentum of the system, calculated about O and P are denoted by L_O and L_P respectively, then



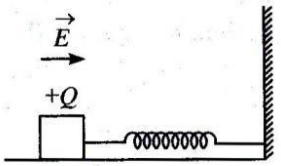
(a) L_O and $\vec{L}_P$ do not very with time

(b) $\vec{L}_O$ varies with time while $\vec{L}_P$ remains constant

(c) $\vec{L}_O$ remains constant while $\vec{L}_P$ varies with time

(d) $\vec{L}_O$ and $\vec{L}_P$ both vary with time.

24. A wooden block performs SHM on a frictionless surface with frequency ν_0. The block carries a charge $+Q$ on its surface. If now a uniform electrical field $\vec{E}$ is switched on as shown, then the SHM of the block will be



(a) of the same frequency and with shifted mean position

(b) of the same frequency and with the same mean position

(c) of changed frequency and with shifted mean position

(d) of changed frequency and with the same mean position.

25. Two vibrating tuning forks produce progressive waves given by $Y_1 = 4 \sin 500\,\pi t$ and $Y_2 = 2 \sin 506\,\pi t$ where t is in seconds. Number of beats produced per minute is

(a) 60 (b) 3

(c) 369 (d) 180

26. A short-circuited coil is placed in a time-varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be

(a) halved (b) the same

(c) doubled (d) quadrupled

27. Consider atoms H, He^+, Li^{++} in their ground states. If L_1, L_2 and L_3 are magnitude of angular momentum of their electrons about the nucleus respectively then :

(a) $L_1 = L_2 = L_3$ (b) $L_1 > L_2 > L_3$

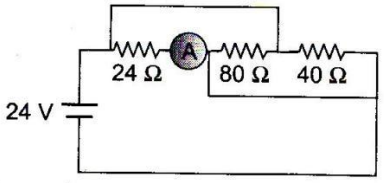
(c) $L_1 < L_2 < L_3$ (d) $L_1 = L_2 = L_3$

28. An energy of 24.6 eV is required to remove one of the electrons from a neutral helium atom. The energy (in eV) required to remove both the electrons from a neutral helium atom is

(a) 79.0 (b) 51.8

(c) 49.2 (d) 38.2

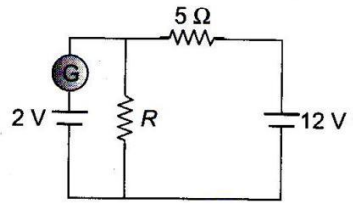
29. In the circuit shown, the reading of ammeter is:



(a) 0.2 A (b) 0.6 A

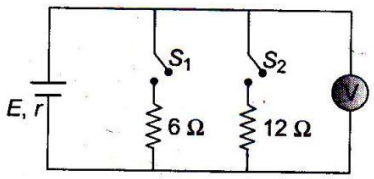
(c) 2 A (d) 1 A

30. For what value of R, current in the galvanometer is zero?



(a) 1 Ω (b) 2 Ω
(c) 5 Ω (d) 7 Ω

31. In the circuit shown, when switch S_1 is closed and S_2 is open, the ideal voltmeter shows a reading of 18 V. When switch S_2 is closed and S_1 is open, the reading of voltmeter is 24 V. When S_1 and S_2 both are closed, the voltmeter reading will be:



(a) 14.4 V (b) 20.6 V
(c) 24.2 V (d) 10.8 V

32. If light of wavelength λ_1 is allowed to fall on a metal, then kinetic energy of photoelectrons emitted is E_1. If wavelength of light changes to λ_2 then kinetic energy of electrons changes to E_2. Then work function of the metal is

(a) $\frac{E_1E_2(\lambda_1-\lambda_2)}{\lambda_1\lambda_2}$ (b) $\frac{E_1\lambda_1-E_2\lambda_2}{(\lambda_1-\lambda_2)}$

(c) $\frac{E_1\lambda_1-E_2\lambda_2}{(\lambda_2-\lambda_1)}$ (d) $\frac{\lambda_1\lambda_2E_1E_2}{(\lambda_2-\lambda_1)}$

33. A beam of light of wavelength λ is totally reflected at normal incidence by a plane mirror. The intensity of the light is such that photons hit the mirror at a rote n. Given that the Planck constant is h, the force exerted on the mirror by this beam is

(a) $nh\lambda$ (b) nh/λ
(c) $2nh/\lambda$ (d) $2n\lambda/h$

34. A ring of radius R, has charge $-Q$ distributed uniformly over it. A charge q is placed at the centre of the ring such that the electric field becomes zero at a point on the axis of the ring distant 'R' from the centre of the ring. The value of charge q is

(a) $\frac{Q}{2}\sqrt{3}$ (b) $\frac{Q}{4}\sqrt{2}$

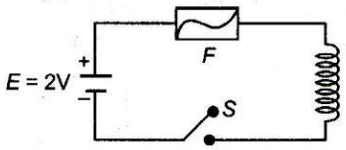
(c) $\frac{Q}{3}\sqrt{2}$ (d) $\frac{Q}{4}\sqrt{3}$

35. There are three concentric thin spheres of radius a, b, c ($a > b > c$). The total surface charge densities on their surfaces are σ, $-\sigma$, σ respectively. The magnitude of electric field at r (distance from centre) such that $a > r > b$ is:

(a) 0 (b) $\frac{\sigma}{\epsilon_0 r^2}(b^2-c^2)$

(c) $\frac{\sigma}{\epsilon_0 r^2}(a^2+b^2)$ (d) none of these

36. In the circuit shown, the cell is deal. The coil has an inductance of 4 H and zero resistance. F is a fuse of zero resistance and will blow when the current through it reaches 5 A. The switch is closed at $t = 0$. The fuse will blow:



(a) almost at once (b) after 2 sec
(c) after 5 sec (d) after 10 sec

37. A parallel plate capacitor consists of two circular plates each of radius 12 cm and separated by 5.0 mm. The capacitor is being charged by external source. The charging current is constant and is equal to 0.15 A. The rate of change of potential difference between the plates will be:

(a) 1.873×10^7 V/s (b) 1.873×10^8 V/s
(c) 1.873×10^9 V/s (d) 1.873×10^{10} V/s

38. Three equal charges Q are placed at the three vertices of an equilateral triangle. What should be the value of a charge, that when placed at the centroid, reduces the interaction energy of the system to zero?

(a) $\frac{-Q}{2}$ (b) $\frac{-Q}{3}$

(c) $\frac{-Q}{2\sqrt{3}}$ (d) $\frac{-Q}{\sqrt{3}}$

39. A concave lens and a convex lens have same focal length of 20 cm and both put in contact this combination is used to view an object 5 cm long kept at 20 cm from the lens combination. As compared to object the image will be

(a) Magnified and inverted
(b) Reduced and erect
(c) Of the same size and erect
(d) Of the same size and inverted

40. A boy is trying to start a fire by focusing sunlight on a piece of paper using an equiconvex lens of focal length 10 cm. The diameter of the sun is 1.39×10^9 m and its mean distance from the earth is 1.5×10^{11} m. What is the diameter of the sun's image on the paper?

(a) 9.2×10^{-4} m (b) 6.5×10^{-4} m

(c) 6.5×10^{-5} m (d) 12.4×10^{-4} m

41. A biconvex lens has a radius of curvature of magnitude 20 cm. Which one of the following options describes best the image formed of an object of height 2 cm placed 30 cm from the lens?

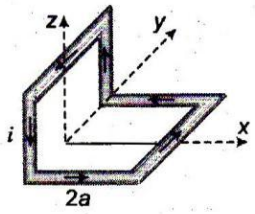
(a) Virtual, upright, height = 0.5 cm

(b) Real, inverted, height = 4 cm

(c) Real, inverted, height = 1 cm

(d) Virtual, upright, height = 1 cm

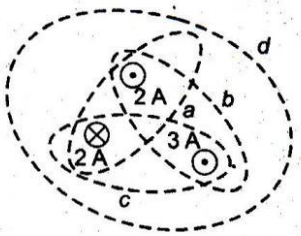
42. A non-planar loop of conducting wire carrying a current i is placed as shown in the figure. Each of the straight sections of the loop is of length $2a$. The magnetic field due to this loop at the point $P(a, 0, a)$ points in the direction



(a) $\frac{1}{\sqrt{2}}(-\hat{j}+\hat{k})$ (b) $\frac{1}{\sqrt{3}}(-\hat{j}+\hat{k}+\hat{i})$

(c) $\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k})$ (d) $\frac{1}{\sqrt{2}}(\hat{i}+\hat{k})$

43. Rank the value of $\oint \vec{B}.\vec{dl}$ for the closed paths shown in figure from the smallest to largest.



(a) a, b, c, d (b) a, c, d, B

(c) a, d, c, b (d) a, c, b, d

44. **Workdone by friction can be**

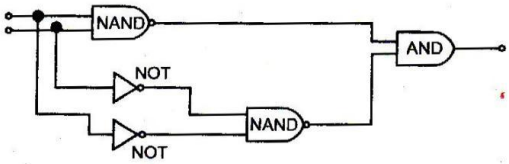
(a) negative only

(b) positive only

(c) always zero

(d) can be any thing

45. The diagram shows a logic network.

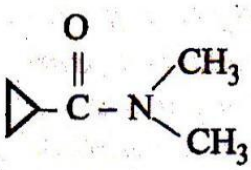


Which single gate is equivalent to the network?

(a) EX-NOR (b) NOR

(c) EX-OR (d) OR

46. **IUPAC name of the following compound :**



(a) N, N-dimethylcyclopropanecarboxamide

(b) N-methylcyclopropanamide

(c) cyclopropionamide

(d) none of the above

47. **The electrical charge on a colloidal particle is observed by:**

(a) Ultramicroscope

(b) Scattering

(c) Brownian movement

(d) Electrophoresis

48. **A is a lighter phenol and B is an aromatic carboxylic acid. Separation of a mixture of A and B can be carried out easily by using a solution of**

(a) Sodium hydroxide (b) Sodium sulphate

(c) calcium chloride (d) Sodium bicarbonate

49. $(Ag + Pb)$ alloy $\xrightarrow{\text{Melt and Zinc is added}}$ $(Ag + Pb + Zn)$ melt $\xrightarrow{\text{Cool}}$ $\xrightarrow[\text{Layer Y}]{\text{Layer X}}$

Select correct statement based on above scheme.

(a) Layer X contains Zn and Ag
(b) Layer Y contains Pb and Ag but amount of silver in this layer is smaller than in layer X
(c) X and Y are immiscible layers
(d) All are correct statements

50. For the reaction : $H_2 + Cl_2 \xrightarrow{\text{sunlight}} 2HCl$ the order of reaction is

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

51. Which of the following is not correct ?

(a) $3O_2 \underset{\text{discharge}}{\overset{\text{Silent electric}}{\rightleftharpoons}} 2O_3$; $\Delta H = -284.5$ kJ.

(b) Ozone undergoes addition reaction with unsaturated carbon compounds.
(c) Sodium thiosulphate reacts with I_2 to form sodium tetrathionate and sodium iodide.
(d) Ozone oxidises lead sulphide to lead sulphate.

52. (I) $n = 3, l = 2, m_l = -2$
(II) $n = 3, l = 1, m_l = 0$
(III) $n = 3, l = 0, m_l = -1$
(IV) $n = 3, l = 2, m_l = 0$
(V) $n = 3, l = 3, m_l = -2$

Of these question state designation which does not describe an allowed state for an electron in an atom ?

(a) I and IV (b) III and V
(c) II and V (d) IV and V

53. Which of the following compounds is a good conductor of electricity in solution state?

(a) covalent (b) molecular solid
(c) metallic solid (d) ionic compounds

54. Which is the most suitable reagent among the following to distinguish compound (3) from rest of the compounds ?

1. $CH_3 - C \equiv C - CH_3$
2. $CH_3 - CH_2 - CH_2 - CH_3$
3. $CH_3 - CH_2C \equiv CH$
4. $CH_3 - CH = CH_2$.

(a) Bromine in carbon tetrachloride
(b) Bromine in acetic acid
(c) Alk $KMnO_4$
(d) Ammonical silver nitrate.

55. $N_2 + 3H_2 \longrightarrow 2NH_3$. In this reaction equivalent weight of N_2 is

(a) 4.67 (b) 28
(c) 14 (d) 2.33

56. Which of the following is/are the hazardous pollutant(s) present in automobile exhaust gases?

(i) N_2 (ii) CO
(iii) CH_4 (iv) Oxides of nitrogen
(a) (ii) and (iii) (b) (i) and (ii)
(c) (ii) and (iv) (d) (i) and (iii)

57. $Zn^{2+} \rightarrow Zn_{(s)}$; $E^0 = -0.76$ V

$Cu^{2+} \rightarrow Cu_{(s)}$; $E^0 = -0.34$ V

Which of the following is spontaneous?

(a) $Zn^{2+} + Cu \rightarrow Zn + Cu^{2+}$
(b) $Cu^{2+} + Zn \rightarrow Cu + Zn^{2+}$
(c) $Zn^{2+} + Cu^{2+} \rightarrow Zn + Cu$
(d) None of these

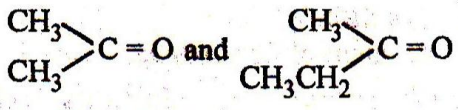
58. Cuprous compounds such as CuCl, CuCN and CuSCN are the only salts stable in water due to

(a) high hydration energy of Cu^+ ions
(b) their inherent tendency not do disproportionate
(c) diamagnetic nature
(d) insolubility in water

59. A compound formed by elements X and Y crystallizes in a cubic structure in which the X atoms are at the corners of a cube and the Y atoms are at the face centres. The formula of the compound is

(a) XY_3 (b) X_3Y
(c) XY (d) XY_2

60. An alkene having molecular formula C_7H_{14} was subjected to ozonolysis in the presence of zinc dust. An equimolar amount of the following two compounds was obtained



The IUPAC name of the alkene is

(a) 3, 4-dimethyl-3-pentene
(b) 3, 4-dimethyl-2-pentene
(c) 2, 3-dimethyl-3-pentene
(d) 2, 3-dimethyl-2-pentene

61. At a particular temperature, the vapour pressures of two liquids A and B are respectively 120 and 180 mm of mercury. If 2 moles of A and 3 moles of B are mixed to form an ideal solution, the vapour pressure of the solution at the same temperature will be (in mm of mercury)

(a) 156 (b) 145
(c) 150 (d) 108

62. Which of the following complex ions is expected to absorb visible light?

(a) $[Ti(en)_2(NH_3)_2]^{4+}$
(b) $[Cr(NH_3)_6]^{3+}$
(c) $[Zn(NH_3)_6]^{2+}$
(d) $[Sc(H_2O)_3(NH_3)_3]^{3+}$

(At. no. Zn = 30, Sc = 21, Ti = 22, Cr = 24)

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

(a) Adsorption lowers the activation energy of the reaction
(b) The concentration of reactant molecules at the active centres of the catalyst becomes high due to strong adsorption
(c) In the process of adsorption, the activation energy of the molecules becomes large
(d) Adsorption produces heat which increases the speed of the reaction

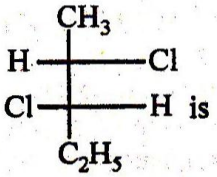
64. A pressure cooker reduces cooking time for food because

(a) boiling point of water involved in cooking is increased
(b) the higher pressure inside the cooker crushes the food material
(c) cooking involves chemical changes helped by a rise in temperature
(d) heat is more evenly distributed in the cooking space

65. Most reactive halide towards $S_{N}1$ reaction is

(a) *n*-Butyl chloride
(b) *sec*-Butyl chloride
(c) *tert*-Butyl chloride
(d) Allyl chloride

66. The absolute configuration of the following :



(a) 2S, 3R (b) 2S, 3S
(c) 2R, 3S (d) 2R, 3R

67. The rate constant k, for the reaction

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

is $1.3 \times 10^{-2} s^{-1}$. Which equation given below describes the change of $[N_2O_5]$ with time ? $[N_2O_5]_0$ and $[N_2O_5]_t$ corrospond to concentration of N_2O_5 initially and at time t.

(a) $[N_2O_5]_t = [N_2O_5]_0 + kt$
(b) $[N_2O_5]_0 = [N_2O_5]_t e^{kt}$
(c) $\log [N_2O_5]_t = \log [N_2O_5]_0 + kt$
(d) $\ln \frac{[N_2P_5]_0}{[N_2P_5]_t} = kt$

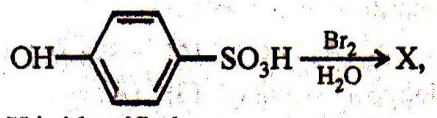
68. Among the following the most stable compound is :

(a) *cis*-1, 2-cyclohexanediol
(b) *trans*-1, 2-cyclohexanediol
(c) *cis*-1,3-cyclohexanediol
(d) *trans*-1, 3-cyclohexanediol

69. Which of the following is true?
(a) Coke is found in nature
(b) Producer gas is a mixture of CO & H_2
(c) CO is used in the extraction of Ni by Mond's process
(d) CO_2 can be prepared by dehydration of formic acid.

70. Aniline is reacted with bromine water and the resulting product is treated with an aqueous solution of sodium nitrite in presence of dilute hydrochloric acid. The compound so formed is converted into a tetrafluoroborate which is subsequently heated dry. The final product is
(a) 1,3, 5-tribromobenzene
(b) p-bromofluorobenzene
(c) p-bromoaniline
(d) 2,4, 6-tribromofluorobenzene

71. With which one of the following elements silicon should be doped so as to give p-type of semiconductor ?
(a) Germanium (b) Arsenic
(c) Selenium (d) Boron

72. 
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

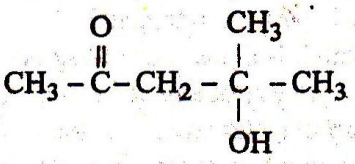
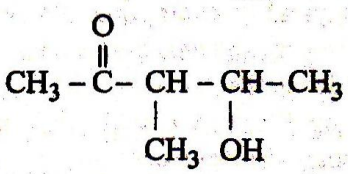
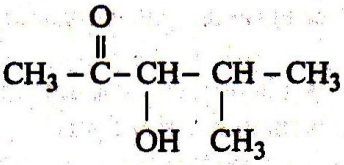
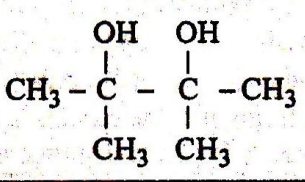
73. The appearance of colour in solid alkali metal halides is generally due to
(a) Schottky defect
(b) Frenkel defect
(c) Interstitial positions
(d) F-centres

74. Which of the following is a basic dye?
(a) Congo red (b) Aniline yellow
(c) Alizarin (d) Indigo

75. Aluminium displaces hydrogen from acids but copper does not. A galvanic cell prepared by combining Cu/Cu^{2+} and Al/Al^{3+} has an e.m.f of 2.0 V at 298°K. If the potential of copper electrode is + 0.34 V, that of aluminium is
(a) +1.66 (b) −1.66
(c) +2.34 (d) −2.3 V

76. An organic compound X on treatment with pyridinium chlorochromate in dichloromethane gives compound Y. Compound Y reacts with I_2 and alkali to form triiodomethane. The compound 'X' is
(a) C_2H_5OH (b) CH_3CHO
(c) CH_3COCH_3 (d) CH_3COOH

77. A sudden large jumps between the values of second and third ionization energies of an element, would be associated with which of the following electronic configuration?
(a) $1s^2, 2s^2, 2p^6, 3s^1$
(b) $1s^2, 2s^2, 2p^6, 3s^1, 3p^1$
(c) $1s^2, 2s^2, 2p^6, 3s^2$
(d) $1s^2, 2s^2, 2p^6, 3s^2, 3p^2$

78. Which of the products is formed when acetone is reacted with barium hydroxide solution?
(a) 
(b) 
(c) 
(d) 

79. For the manufacture of NH_3 by the following reaction

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 + 23kcal$$

The favourable conditions are
(a) low temp., high pressure and catalyst
(b) low temp., low pressure and catalyst
(c) high temp., high pressure and catalyst
(d) high temp., low pressure and catalyst

80. Ethanol can be prepared more easily by which reaction ?

(i) $CH_3CH_2Br + H_2O \longrightarrow CH_3CH_2OH$

(ii) $CH_3CH_2Br + Ag_2O$ (in boiling water) $\longrightarrow CH_3CH_2OH$

(a) by (i) reaction
(b) by (ii) reaction
(c) Both reactions proceed at same rate
(d) by none

81. The oxidation states of iodine in HIO_4, H_3IO_5 and H_5IO_6 are respectively
(a) $+1, +3, +7$ (b) $+7, +7, +3$
(c) $+7, +7, +7$ (d) $+7, +5, +3$

82. Which is correct statement?
(a) Starch is a polymer of α-glucose
(b) In cyclic structure of fructose, there are four carbons and one oxygen atom
(c) Amylose is a component of cellulose
(d) Proteins are composed of only one type of amino acids

83. Regarding F^- and Cl^- which of the following statements is/are correct?
(i) Cl^- can give up an electron more easily than F^-
(ii) Cl^- is a better reducing agent than F^-
(iii) Cl^- is smaller in size than F^-
(iv) F^- can be oxidized more readily than Cl^-
(a) (i) and (ii) (b) (i), (ii) and (iv)
(c) (iii) and (iv) (d) only (i)

84. Among the following, the species having square planar geometry for central atom are
(i) XeF_4 (ii) SF_4
(iii) $[NiCl_4]^{2-}$ (iv) $[PtCl_4]^{2-}$
(a) (i) and (iv) (b) (i) and (ii).
(c) (ii) and (iii) (d) (iii) and (iv)

85. Water glass is :
(a) Na_2SiO_3 (b) Mg_2Si
(c) $SiCl_4$ (d) $Ca(H_2PO_4)_2$

86. Which one of the following statement is *not true*?
(a) In vulcanization the formation of sulphur bridges between different chains make rubber harder and stronger.
(b) Natural rubber has the *trans* -configuration at every double bond
(c) Buna-S is a copolymer of butadiene and styrene
(d) Natural rubber is a 1, 4 - polymer of isoprene

87. For a first order reaction, to obtain a positive slope, we need to plot {where [A] is the concentration of reactant A}
(a) $-\log_{10}[A]$ *vs* t (b) $-\log_e[A]$ *vs* t
(c) $\log_{10}[A]$ *vs* log t (d) [A] *vs* t

88. Among the following molecules
(i) XeO_3 (ii) $XeOF_4$ (iii) XeF_6
Those having same number of lone pairs on Xe are
(a) (i) and (ii) only (b) (i) and (iii) only
(c) (ii) and (iii) only (d) (i), (ii) and (iii)

89. The de-Broglie wavelength associated with a particle of mass 10^{-6} kg moving with a velocity of 10 ms^{-1} is :
(a) 6.63×10^{-7} m (b) 6.63×10^{-16} m
(c) 6.63×10^{-21} m (d) 6.63×10^{-29} m

90. Which of the following is not a fat soluble vitamin?
(a) Vitamin B complex (b) Vitamin D
(c) Vitamin E (d) VitaminA

SECTION 3 - BOTANY

91. The first organisms to appear on earth were
(a) photoautotrophs (b) chemoautotrophs
(c) chemoheterotrophs (d) heterotrophs

92. Floridean starch is found in
(a) chlorophyceae (b) rhodophyceae
(c) phaeophyceae (d) cyanophyceae

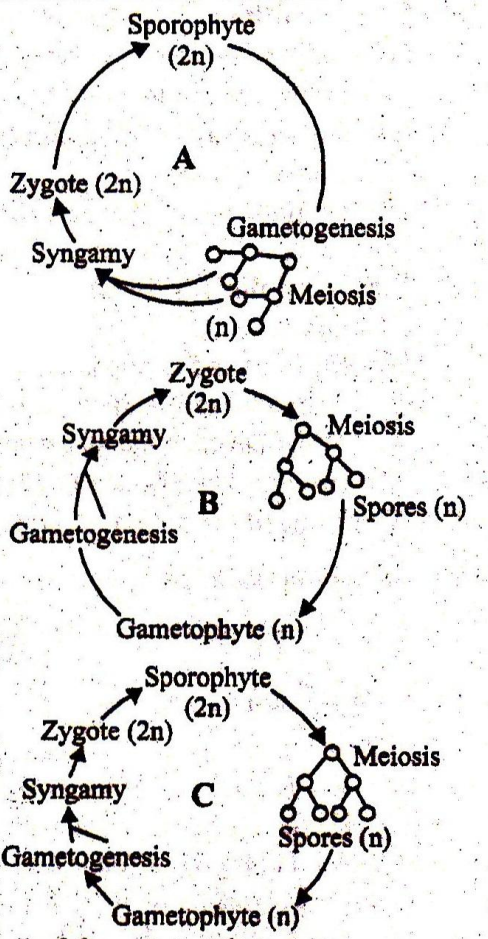
93. A water fern which is used as a green manure in rice fields is
(a) *Salvinia* (b) *Mucor*
(c) *Aspergillus* (d) *Azolla*

94. Which of the following does not have stomata ?
(a) Hydrophytes
(b) Mesophytes
(c) Xerophytes
(d) Submerged hydrophytes

95. Which is correct about transport or conduction of substances?
(a) Organic food moves up through phloem
(b) Organic food moves up through xylem
(c) Inorganic food moves upwardly and downwardly through xylem
(d) Organic food moves upwardly and downwardly through phloem

96. The quiescent centre in root meristem serves as a
(a) site for storage of food which is utilized during maturation.
(b) reservoir of growth hormones.
(c) reserve for replenishment of damaged cells of the meristem.
(d) region for absorption of water.

97. Which one of the following option correctly represents the type of life cycle patterns?
(a) A - Diplontic, B - Haplodiplontic, C - Haplontic
(b) A - Haplodiplontic, B - Haplontic, C - Diplontic
(c) A - Haplontic, B - Diplontic, C - Haplodiplontic
(d) A - Diplontic, B - Haplontic, C - Haplodiplontic



98. The "Eyes" of the potato tuber are
(a) root buds (b) flower buds
(c) shoot buds (d) axillary buds

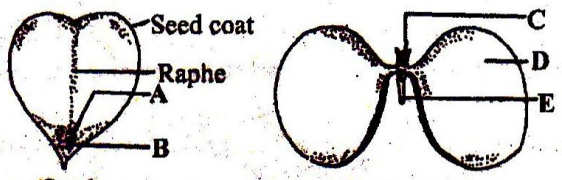
99. Acid rains are produced by
(a) excess emissions of NO_2 and SO_2 from burning fossil fuels
(b) excess production of NH_3 by industry and coal gas
(c) excess release of carbon monoxide by incomplete combustion
(d) excess formation of CO_2 by combustion and animal respiration

100. Which of these is a pollution related to occupational health hazard disease ?
(a) Pneumoconiosis (b) Asthma
(c) Flurosis (d) Silicosis

101. Stirred tank bioreactors have been designed for
(a) addition of preservatives to the product
(b) purification of the product
(c) ensuring anaerobic conditions in the culture vessel
(d) availability of oxygen throughout the process

102. Which of the following pair has haploid structures?
(a) Nucellus and antipodal cells
(b) Antipodal cells and egg cell
(c) Antipodal cells and megaspore mother cell
(d) Nucellus and primary endosperm nucleus

103. Which one of the option is correct?



(a) A - Hilum, B - Micropyle, C - Radicle, D - Cotyledon, E - Plumule
(b) A - Hilum, B - Micropyle, C - Plumule, D - Cotyledon, E - Radicle
(c) A - Micropyle, B - Hilum, C - Plumule, D - Cotyledon, E - Radicle
(d) A - Hilum, B - Micropyle, C - Plumule, D - Radicle, E - Cotyledon

104. Double fertilization is fusion of
(a) two eggs
(b) two eggs and polar nuclei with pollen nuclei
(c) one male gamete with egg and other with synergid
(d) one male gamete with egg and other with secondary nucleus

105. Plasmolysis occurs when the cell is placed in
(a) isotonic solution
(b) hypotonic solution
(c) hypertonic solution
(d) None of the above

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

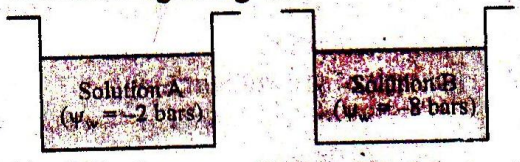
107. The organelles which take part in photo-respiration are
(a) chloroplast, mitochondria, nucleus
(b) chloroplast, mitochondria, lysosome
(c) mitochondria, chloroplast, peroxisome
(d) mitochondria, lysosomes, peroxisome

108. Photosynthetically active radiation is represented by the range of wavelength of
(a) 340-450 nm (b) 400-700 nm
(c) 500-600 nm (d) 400-950 nm

109. Which one of the following is essential for photolysis of water ?
(a) Manganese (b) Zinc
(c) Copper (d) Boron

110. Which element is required in the germination of pollen grain?
(a) Chlorine (b) Potassium
(c) Boron (d) Calcium

111. Study the figure and choose the correct statement regarding this.



(a) Kinetic energy (K.E.) of H_2O in A solution > K.E. of water in B solution.
(b) K.E. of water in B solution > K.E. of water in A solution.
(c) K.E. of water in A solution = K.E. of H_2O in B solution.
(d) Water potential has nothing to do with K.E. of water in a solution.

112. The dihybrid ratio in F_2 - generation is
(a) 1 : 1 : 1 : 1 (b) 2 : 1 : 2 : 1
(c) 3 : 1 (d) 9 : 3 : 3 : 1

113. The zone of atmosphere that lies near the ground is
(a) troposphere (b) stratosphere
(c) homosphere (d) ionosphere

114. Reverse transcriptase is
(a) RNA dependent RNA polymerase
(b) DNA dependent RNA polymerase
(c) DNA dependent DNA polymerase
(d) RNA dependent DNA polymerase

115. Jaya and Ratna developed for green revolution in India are the varieties of
(a) maize (b) rice
(c) wheat (d) bajra

116. A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this.
(i) Lots of urea and phosphate fertilizer were used in the crops in the vicinity
(ii) The area was sprayed with DDT by an aircraft
(iii) The lake water turned green and stinky
(iv) Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis.
(a) (i) and (iii) (b) (i), (ii) and (iv)
(c) (iii) and (iv) (d) (ii), (iii) and (iv)

117. Which of the following ecosystems has highest rate of gross primary production?
(a) Grasslands
(b) Mangroves
(c) Coral reefs
(d) Equatorial rain forest

118. Glycogen is a polymer of
(a) galactose (b) glucose
(c) fructose (d) sucrose

119. What is the end product of glycolysis of a glucose molecule?
(a) Fructose 1, 6- diphosphate
(b) Pyruvate and ATP
(c) Phosphoglyceraldehyde
(d) Lactic acid and ATP

120. Which one of the following acids is a derivative of carotenoids ?
(a) Indole-3 -acetic acid
(b) Gibberellic acid
(c) Abscisic acid
(d) Indole butyric acid

121. Which one of the following generally acts as an antagonist to gibberellins?
(a) Zeatin (b) Ethylene
(c) ABA (d) IAA

122. Other than DNA polymerase, which is/ are the enzyme(s) involved in DNA synthesis?
(a) Topoisomerase (b) Helicase
(c) RNA primase (d) All of these

123. Which of the following is not true for oxidative phosphorylation?
(a) It uses oxygen as the initial electron donor.
(b) It involves the redox reactions of electron transport chain.
(c) It involves an ATP synthase located in the inner mitochondrial membrane.
(d) It depends on chemiosmosis.

124. Consumption of which one of the following foods can prevent the kind of blindness associated with vitamin 'A' deficiency ?
(a) '*Flavr Savr*' tomato
(b) Canolla
(c) Golden rice
(d) Bt-Brinjal

125. Biodiversity of a geographical region represents
(a) endangered species found in the region.
(b) the diversity in the organisms living in the region.
(c) genetic diversity present in the dominant species of the region.
(d) species endemic to the region.

126. Use of transgenic plants as biological factories for the production of special chemicals is called–
(a) Molecular farming
(b) Molecular genetics
(c) Molecular mapping
(d) Dry farming

127. Which animal has become extinct from India?
(a) Snow Leopard (b) Hippopotamus
(c) Wolf (d) Cheetah

128. Agarose extracted from sea weeds finds use in :
(a) Spectrophotometry
(b) Tissue culture
(c) PCR
(d) Gel electrophoresis

129. Streptomycin is obtained from
(a) *Streptomyces griseus*
(b) *S. aureofaciens*
(c) *S. venezuelae*
(d) *S. ramosus*

130. The nucleolus is the site of formation of
(a) spindle fibres (b) chromosomes
(c) ribosomes (d) peroxysomes

131. Niche overlap indicates
(a) two different parasites on the same host
(b) sharing of one or more resources between the two species
(c) mutualism between two species
(d) active cooperation between two species

132. Coconut milk (coconut water) is widely used in tissue culture because it contains
(a) auxins (b) ethylene
(c) cytokinin (d) gibberellins

133. The okazaki fragments in DNA chain growth
(a) polymerize in the 3' - to - 5' direction and forms replication fork
(b) prove semi-conservative nature of DNA replication
(c) polymerize in the 5' - to - 3' direction and explain 3' - to - 5' DNA replication
(d) result in transcription

134. Leghaemoglobin helps in
(a) nitrogen fixation
(b) protecting nitrogenase from O_2
(c) destroys bacteria
(d) transport of food in plants

135. Important objective of biotechnology in agriculture section is –
(a) To produce pest resistant varieties of plants
(b) To increase the nitrogen content
(c) To decrease the seed number
(d) To increase the plant weight

ZOOLOGY

136. A chordate character is
(a) gills
(b) spiracles
(c) postanal tail
(d) chitinous exoskeleton

137. Which bacteria is utilized in gober gas plant?
(a) Methanogens
(b) Nitrifying bacteria
(c) Ammonifying bacteria
(d) Denitrifying bacteria

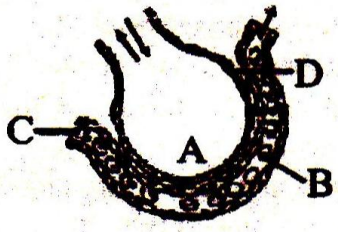
138. Excretory organs of Cockroach are
(a) flame cells
(b) nephridia
(c) hreen glands
(d) malpighian tubules

139. What is common among silverfish, scorpion, crab and honey bee?
(a) Compound eyes
(b) Poison gland
(c) Jointed legs
(d) Metamorphosis

140. Tendons and ligaments are the example of
(a) areolar connective tissue
(b) adipose tissue
(c) dense regular connective tissue
(d) loose connective tissue

141. The type of epithelial cells which line inner surface of fallopian tubes, bronchioles and small bronchi are known as
(a) squamous epithelium
(b) columnar epithelium
(c) ciliated epithelium
(d) cubical epithelium

142. The figure given below shows a small part of human lung where exchange of gases takes place. In which one of the options given below, the one part A, B, C or D is correctly identified along with its function?



Options
(a) B : Red blood cell - transport of CO_2 mainly
(b) C : Arterial capillary - passes oxygen to tissues
(c) A : alveolar cavity - main site of exchange of respiratory gases
(d) D : Capillary wall - exchange of O_2 and CO_2 takes place here

143. Which one of the following groups of structures/organs have similar function?
(a) Typhlosole in earthworm, intestinal villi in rat and contractile vacuole in *Amoeba*.
(b) Nephridia in earthworm, malpighian tubules in cockroach and urinary tubules in rat.
(c) Antennae of cockroach, tympanum of frog and clitellum of earthworm.
(d) Incisors of rat, gizzard (proventriculus) of cockroach and tube feet of starfish.

144. The correct sequence in the process of development of human embryo is
(a) fertilization—zygote—cleavage—morula—blastula—gastrula
(b) fertilization—cleavage—morula—zygote—blastula—gastrula
(c) fertilization—zygote—blastula—morula—cleavage—gastrula
(d) cleavage—zygote—fertilization—morula—blastula—gastrula

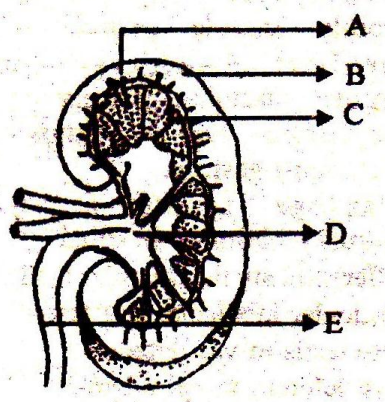
145. Vasa efferentia are the ductules leading from
(a) testicular lobules to rete testis
(b) rete testis to vas deferens
(c) vas deferens to epididymis
(d) epididymis to urethra

146. Which one of the following is the correct matching of the events occurring during menstrual cycle?
(a) Proliferative phase: Rapid regeneration of myometrium and maturation of Graffian follicle.
(b) Development of corpus luteum : Secretory phase and increased secretion of progesterone.
(c) Menstruation: Breakdown of myometrium and ovum not fertilised.
(d) Ovulation: LH and FSH attain peak level and sharp fall in the secretion of progesterone.

147. The number of births per thousand people in the population is expressed as :
(a) Reproduction rate (b) Conception rate
(c) Crude birth rate (d) Growth rate

148. Umbilical cord has
(a) Two arteries carrying blood to placenta and one vein returning blood to foetus
(b) One artery carrying blood to placenta and two veins returning blood to foetus
(c) Two arteries bringing blood to foetus and one vein carrying blood to placenta
(d) One artery bringing blood to foetus and two veins carrying blood to placenta

149. Refer the following diagram and identify the parts of a kidney indicated



(a) A = Cortex, B = Nephron, C = Pelvis, D = Medulla, E = Ureter
(b) A = Cortex, B = Medulla, C = Nephron, D = Pelvis, E = Ureter
(c) A = Nephron, B = Cortex, C = Medulla, D = Ureter, E = Pelvis
(d) A = Nephron, B = Cortex, C = Medulla, D = Pelvis, E = Ureter

150. The logistic population growth is expressed by the equation :

(a) $dt/dN = Nr\left(\frac{K-N}{K}\right)$

(b) $dN/dt = rN\left(\frac{K-N}{K}\right)$

(c) $dN/dt = rN$

(d) $dN/dt = rN\left(\frac{N-K}{N}\right)$

151. Which one of the following pairs of food components in humans reaches the stomach totally undigested ?
(a) Starch and cellulose
(b) Protein and starch
(c) Starch and fat
(d) Fat and cellulose

152. Which one of the following is a correct matching pair?
(a) Lubb - Sharp closure of AV valves at the beginning of ventricular systole.
(b) Dup - Sudden opening of semilunar valves at the beginning of ventricular diastole.
(c) Pulsation of the radial artery valves in the blood vessels.
(d) Purkinje fibers - Initiation of the heart beat.

153. Proximal and distal convoluted tubules are parts of
(a) Seminiferous tubules (b) Nephron
(c) Oviduct (d) Vas deferens

154. Which one of the components of ECG in human is correctly interpreted below ?
(a) Complex QRS-One complete Pulse
(b) Peak T - Initiation of total cardiac contraction
(c) Peak P and Peak R together-Systolic and diastolic blood pressures
(d) Peak P- Initiation of left atrial contraction only

155. With reference to the blood in a normal person, which one of the following statements is correct?
(a) Compared to arteries, veins are less numerous and hold less of the body's blood at any given time.
(b) Blood cells constitute about 70 percent of the total volume of the blood.
(c) White blood cells (WBC) are made by lymph nodes only.
(d) The blood has more platelets than WBC.

156. Deposition of uric acid crystals within the synovial joint causes:
(a) osteoarthritis
(b) rheumatoid arthritis
(c) gout
(d) paralysis

157. Homologous organs are
(a) Wings of Insects and Bat
(b) Gills of Fish and lungs of Rabbit
(c) Pectoral fins of Fish and fore limbs of Horse
(d) Wings of Grosshopper and Crow

158. In Down's syndrome of a male child, the sex complement is
(a) XO (b) 45XY
(c) 45XX (d) XXY

159. Which of the following combinations is generally recommended for composite fish farming in India?
(a) *Catla, Labeo, Cirrhinus*
(b) *Catla, Cyprinus, Clarias*
(c) *Clarias, Channa, Cyprinus*
(d) *Cirrhinus, Cyprinus, Channa*

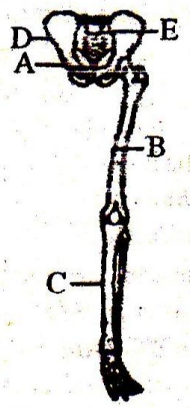
160. Lack of independent assortment of two genes A and B in fruit fly *Drosophila* is due to
(a) repulsion (b) recombination
(c) linkage (d) crossing over

161. Jurassic period of the mesozoic era was characterised by
(a) Radiation of reptiles and origin of mammal-like reptiles
(b) Dinosaurs become extinct and angiosperms appeared
(c) Flowering plants and first dinosaurs appeared
(d) Gymnosperms were dominant plants and first birds appeared

162. The "Cri-du-Chat" syndrome is caused by change in chromosome structure involving
(a) deletion (b) duplication
(c) inversion (d) translocation

163. In history of biology, human genome project led to the development of :
(a) biotechnology (b) biomonitoring
(c) bioinformatics (d) biosystematics

164. Look at the diagram given below.



Parts labelled as 'A', 'B', 'C', 'D' and 'E' respectively indicate
(a) ilium, femur, tibia, pubis and sacrum
(b) pubis, tibia, femur, ilium and sacrum
(c) ilium, femur, tibia, pubis, and sacrum
(d) pubis, femur, tibia, ilium and sacrum

165. Oxygen dissociation curve of haemoglobin is
(a) Sigmoid (b) Hyperbolic
(c) Linear (d) Hypobolic

166. Which of the following is made up of a single bone in mammal ?
(a) Dentary (b) Hyoid
(c) Upper jaw (d) All of these

167. Intercostal muscles are found attached with
(a) diaphragm (b) ribs
(c) pleura (d) lungs

168. Eustachian tube connects
(a) External ear with middle ear
(b) External ear with internal ear
(c) Middle ear with pharynx
(d) Internal pharynx

169. Which one of the following pairs correctly matches a hormone with a disease resulting from its deficiency?
(a) Luteinizing - Failure of ovulation
(b) Insulin - Diabetes insipidus
(c) Thyroxine - Tetany
(d) Parathyroid - Diabetes mellitus

170. Which one of the following is not a second messenger in hormone action ?
(a) Calcium (b) Sodium
(c) cAMP (d) cGMP

171. A genetically engineered bacteria used for clearing oil spills is :
(a) *Escherischia coli*
(b) *Bacillus subtilis*
(c) *Agrobacterium tumifaciens*
(d) *Pseudomonas putida*

172. What is true about T-lymphocytes in mammals?
(a) These are produced in thyroid
(b) There are three main types — cytotoxic T-cells, helper T-cells and suppressor T-cells
(c) These originate in lymphoid tissues
(d) They scavenge damaged cells and cellular debris

173. The use of *Cannabis* products (bhang, ganja, charas, marijuana or hashish) causes
(a) depression of brain activity and feeling of calmness
(b) alters thoughts, perceptions and feelings
(c) suppresses brain function and relieves pain
(d) stimulates the nervous system and increases alterness and activity.

174. During anaerobic digestion of organic waste, such as in producing biogas, which one of the following is left undegraded ?
(a) Lipids
(b) Lignin
(c) Hemi-cellulose
(d) Cellulose

175. Carcinoma refers to
(a) benign tumours of the connective tissue
(b) malignant tumours of the connective tissue
(c) malignant tumours of the skin or mucous membrane
(d) malignant tumours of the colon

176. Short-lived immunity acquired from mother to foetus across placenta or through mother's milk to the infant is categorised as
(a) innate non-specific immunity
(b) active immunity
(c) passive immunity
(d) cellular immunity

177. African sleeping sickness is due to
(a) *Plasmodium vivax* transmitted by Tsetse fly
(b) *Trypanosoma lewsii* transmitted by Bed Bug
(c) *Trypanosoma gambiense* transmitted by *Glossina palpalis*
(d) *Entamoeba gingivalis* spread by Housefly

178. Which one of the following are rich in fructose, calcium and some enzymes?
(a) Male accessory glands
(b) Liver
(c) Pancreas
(d) Salivary glands

179. The number of floating ribs, in the human body, is
(a) 6 pairs (b) 5 pairs
(c) 3 pairs (d) 2 pairs

180. Which one of the following statements is correct?
(a) Cro-Magnon man's fossil has been found in Ethiopia
(b) *Homo erectus* is the ancestor of man
(c) Neanderthal man is the direct ancestor of *Homo sapiens*
(d) *Australopithecus* is the real ancestor of modern man