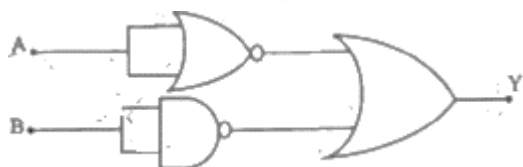


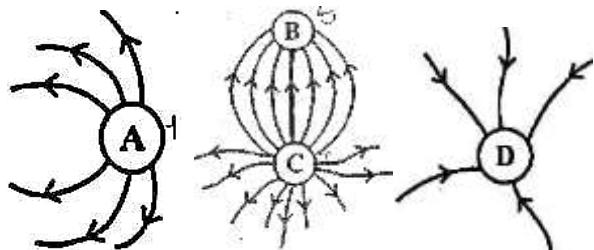
Physics

- Two slits are made 10 millimeter apart and the screen is placed 1.5 metre away. What is the fringe separation when n wavelength of $7000\text{\AA}$ is used? .
(a) $105\mu\text{m}$ (b) $1.05\mu\text{m}$
(c) $10.5\mu\text{m}$ (d) $0.105\mu\text{m}$
- What is the de Broglie wavelength associated with an electron accelerated through a potential difference of 64 volts?
(a) $1.43\text{\AA}$ (b) $1.23\text{\AA}$
(c) $1.53\text{\AA}$ (d) $1.33\text{\AA}$
- An electron, an α -particle and a proton have the same kinetic energy. Which of these have longest de Broglie wavelength?
(a) α -particle (b) proton
(c) electron (d) both α -particle and proton
- The number of photons emitted per second by a bulb of 66 W power emitting waves of wavelength 600 nm is ____ . ($h = 6.6 \times 10^{-34} \text{ J.s}$)
(a) 2×10^{22} (b) 2×10^{19}
(c) 2×10^{21} (d) 2×10^{20}
- The longest wavelength present in the Balmer series of spectral line is
(a) $5438\text{\AA}$ (b) $6563\text{\AA}$
(c) $7369\text{\AA}$ (d) $3646\text{\AA}$
- In hydrogen atom an electron makes a transition from 5th orbit to 3rd orbit. The change in the angular, momentum for this electron is ____
(a) $\frac{h}{\pi}$ (b) $\frac{h}{2\pi}$
(c) $\frac{3h}{\pi}$ (d) $\frac{5h}{\pi}$
- A radioactive isotope has a half- life of 2.5 years. How long will it take the activity to reduce to 1.5625% ?
(a) 10 years (b) 5 years
(c), 15 years (d) 20 years
- In proton-proton cycle in Sun the energy released when an electron & its antiparticle combines is ____
(a) $1.021 \times 10^{-13} \text{ J}$ (b) $0.672 \times 10^{-13} \text{ J}$
(c) $1.126 \times 10^{-13} \text{ J}$ (d) $1.632 \times 10^{-13} \text{ J}$
- The ratio of half-life and average life for a radioactive sample is ____
(a) 2.303 (b) $\log(2)$
(c) $\ln(2)$ (d) e^2
- The given logic circuit behaves as ____ gate.



- NAND
 - NOR
 - NOT
 - OR
- In p-n junction solar cell, the ratio of thickness of p-Si wafer and n-Si layer is approximately ____
(a) 300 (b) 1000
(c) 30 (d) 0.3
 - The semiconductor used for fabrication of visible LEDs must at least have a band gap of
(a) 1.1 eV (b) 1.8 eV
(c) 2.1 eV (d) 3.0 eV

13. Consider a uniform electric field $\vec{E} = 3 \times 10^3 \text{ kN/C}$. The electric flux of this field through a square of 20 cm on a side whose plane is parallel to yz plane is ____ Nm^2/C .
 (a) 90 (b) 120
 (c) 60 (d) Zero
14. Figure shows the electric field lines of four-point charges A, B, C and D.



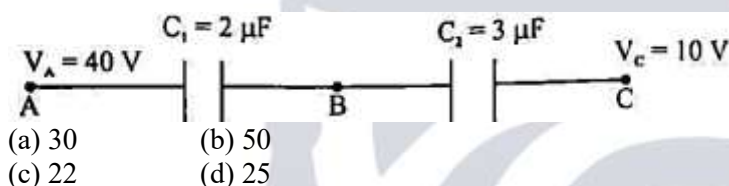
Which charge has the maximum magnitude?

- (a) C charge (b) B charge
 (c) A charge (d) D charge

15. A polythene piece rubbed with wool is found to have a negative charge of $3.52 \times 10^{-7} \text{ C}$. What is the number of electrons transferred?

- (a) 1.1×10^{12} (b) 2.2×10^{12}
 (c) 4.4×10^{12} (d) 5.5×10^{12}

16. The potential at the point B in the given figure is ____ V.



17. A charge Q is placed at the centre of circle of radius 10 cm. Find the work done in moving a charge q between any two points lying on the arc of this circle.

- (a) $KQqJ$ (b) $0.1 KQq J$
 (c) $0.5 KQq J$ (d) $0 J$

18. The dielectric strength of air is ____

- (a) $3 \times 10^9 \text{ V/cm}$ (b) $3 \times 10^9 \text{ V/mm}$
 (c) $3 \times 10^9 \text{ V/μm}$ (d) $3 \times 10^9 \text{ V/m}$

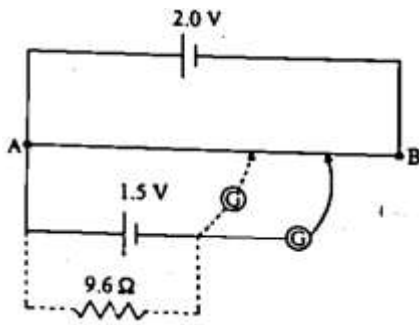
19. Unit of mobility in terms of fundamental units is ____

- (a) $\text{kg}^{-1} \text{ s}^{-2} \text{ A}$ (b) $\text{kg s}^2 \text{ A}$
 (c) $\text{kg}^{-1} \text{ s}^2 \text{ A}$ (d) $\text{kg}^{-1} \text{ s}^2 \text{ A}^{-1}$

20. A metal rod of length 10 cm and a rectangular cross-section of $1 \text{ cm} \times \frac{1}{2} \text{ cm}$ is connected to a battery across opposite faces. The resistance will be ____

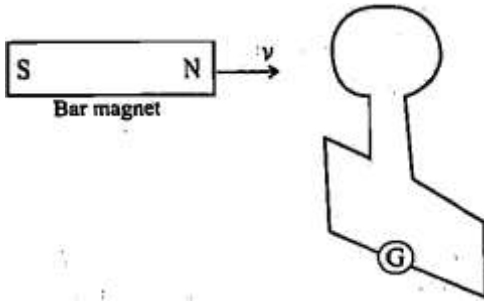
- (a) Maximum when the battery is connected across $10 \text{ cm} \times 1 \text{ cm}$
 (b) Maximum when battery is connected across $1 \text{ cm} \times \frac{1}{2} \text{ cm}$ faces
 (c) Maximum when the battery is connected across $10 \text{ cm} \times \frac{1}{2} \text{ cm}$
 (d) Same irrespective of three faces

21. Figure shows 2.0 V potentiometer used for the determination of internal resistance of 1.5 V cell. The balance point of cell in open circuit is 77.4 cm. When a resistor of 9.6Ω is used in the external circuit of the cell, the balanced point shifts to 64.5 cm length of the potentiometer wire. The internal resistance of the cell is ____ Ω .



- (a) 1.92 (b) 1.5
(c) 1.62 (d) 0.96

22. An electron is projected with uniform velocity along the axis of current carrying long solenoid. Which of the following is true?
(a) The electron path will be circular about the axis
(b) The electron will be accelerated along the axis
(c) The electron will experience a force at 45° to the axis and hence execute a helical path
(d) The electron will continue to move with uniform velocity along the axis of the solenoid
23. An electron is moving at a speed of 3.2×10^7 m/s in a magnetic field of 12×10^{-4} T perpendicular to the direction of motion of electron. The radius of the path of the electron is ____ cm. ($e = 1.6 \times 10^{-19}$ C and $m_e = 9 \times 10^{-31}$ kg)
(a) 30 (b) 13
(c) 15 (d) 26
24. A solenoid of length 0.5 m has a radius of 1 cm and is made up of 250 turns. It carries a current of 5 A. What is the magnitude of the magnetic field inside the solenoid?
(a) 3.14×10^{-3} T (b) 6.28×10^{-3} T
(c) 62.8×10^{-3} T (d) Zero
25. The galvanometer has a resistance of 18Ω . Calculate the value of shunt to increase the range of galvanometer by 10 times.
(a) 4Ω (b) 1Ω
(c) 3Ω (d) 2Ω
26. A bar magnet having pole strength q_m and magnetic moment m is divided into two equal parts along its length. The new pole strength is ____ and the magnetic moment is ____ respectively.
(a) $q_m, \frac{m}{2}$ (b) $\frac{q_m}{2}, m$
(c) $\frac{q_m}{2}, \frac{m}{2}$ (d) q_m, m
27. A solenoid has a core of a material with relative permeability 400. The windings of solenoid are insulated from the core and carry a current of 2 A. If the number of turns is 1000 per metre, the magnetic field B inside the solenoid is ____
(a) 1.5 (b) 1.0
(c) 1.8 (d) 2.0^1
28. The dimensional formula of self-inductance is ____
(a) $M^1 L^1 T^{-2} A^{-2}$ (b) $M^1 L^2 T^{-2} A^{-2}$
(c) $M^{-1} L^{-1} T^2 A^2$ (d) $M^1 L^{-1} T^{-1} A^{-2}$
29. As shown in the figure a bar magnet is moving towards a stationary coil with constant speed v . The direction of induced current in the coil observed by the observer on R.H.S. is ____



- (a) Anticlockwise
- (b) Clockwise
- (c) Current changes its direction randomly
- (d) Induced current will not be produced

30. A circular coil of area 2 cm^2 is placed in a magnetic field of 3 T perpendicularly. The coil has 10 turns and 5Ω resistance. Now the coil is removed from magnetic field in 0.2 s . The value of induced charge flowing through the coil is ____
- (a) 1.1 mC (b) 1.9 mC
 - (c) 1.2 mC (d) Zero
31. A pure inductor of 25.48 mH and a pure resistor of 8Ω are connected in series with an A.C. source of frequency 50 Hz . The phase difference between current (I) and voltage (V) in this circuit is ____
- (a) 45° (b) 30°
 - (c) 60° (d) 90°
32. The charge of the capacitor in L-C oscillatory circuit, when the energy associated with inductor and capacitor are equal, is ____ - [Q_0 is the initial charge on the capacitor].
- (a) $\frac{Q_0}{2}$ (b) Q_0
 - (c) $\frac{Q_0}{\sqrt{3}}$ (d) $\frac{Q_0}{\sqrt{2}}$
33. The output of a stepdown transformer is measured to be 24 V when connected to a 12-watt light bulb. The value of peak current (I_m) is ____ A.
- (a) 1.41 (b) 0.71
 - (c) 2 (d) 2.83
34. If $\vec{E}$ and $\vec{B}$ represent electric and magnetic field vectors of electromagnetic wave, the direction of propagation of electromagnetic wave is along
- (a) $\vec{B}$ (b) $\vec{E}$
 - (c) $\vec{B} \times \vec{E}$ (d) $\vec{E} \times \vec{B}$
35. Frequency range of visible light is ____
- (a) 400 THz to 700 THz
 - (b) 400 GHz to 700 GHz
 - (c) 400 MHz to 700 MHz
 - (d) 400 kHz to 700 kHz
36. The refractive index of air with respect to vacuum is ____
- (a) 1.0029 (b) 1
 - (c) 1.00029 (d) 1.029
37. A lens of power -4.0 Diopter . It means ____
- (a) Concave lens of focal length -25.0 cm
 - (b) Concave lens of focal length -0.25 cm
 - (c) Convex lens of focal length $+0.25 \text{ cm}$
 - (d) Convex lens of focal length $+25.0 \text{ cm}$

38. The earth takes 24 h to rotate once about its axis. How much time does the Sun takes to shift by 1 minute viewed from the earth.
- (a) 4 minutes (b) 40 s
(c) 4 s (d) 40 minutes
39. For what distance a ray optics a good approximation when the aperture is 6 mm wide and the wavelength is $6000\text{\AA}$?
- (a) 50 m (b) 60 m
(c) 40 m (d) 10 m
40. Monochromatic light of wavelength 480 nm is incident from air to glass surface. Refractive index of glass is 1.5. The ratio of the frequency of the incident and refracted light is ____
- (a) 2:1 (b) 1:2
(c) 4:1 (d) 1:1

Chemistry

41. Which one is the common name of the compound $\text{CH}_2 = \text{CH} - \text{CHO}$?

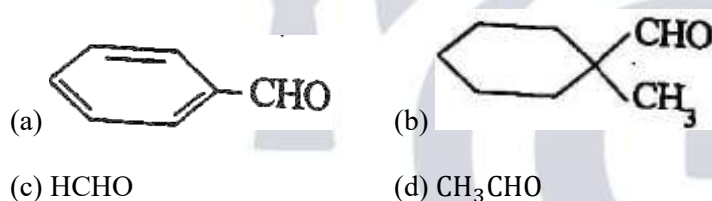
(a) Mesityl Oxide (b) Prop-2-Enal
(c) Acrolein (d) Propanal-1-ene

42. What is the correct order of acidity of compound (I), (II) and (III)?

(i) 4-Nitrobenzoic acid
(ii) 4-Methoxy Benzoic acid
(iii) Benzoic acid

(a) $\text{I} > \text{III} > \text{II}$ (b) $\text{I} > \text{II} > \text{III}$
(c) $\text{I} < \text{II} < \text{III}$ (d) $\text{I} < \text{III} < \text{II}$

43. Which of the following compound does not give cannizzaro reaction?



44. Which compound will give Hoffmann bromamide degradation reaction?

(a) $\text{Ar} - \text{CONH}_2$ (b) $\text{Ar} - \text{NH}_2$
(c) $\text{Ar} - \text{NO}_2$ (d) $\text{Ar} - \text{CH}_2\text{NH}_2$

45. Benzene diazonium chloride reacts with phenol in basic medium to give product. How many σ (sigma) and π (pi) bonds are present in that product?

(a) 16 - σ and 7 - π (b) 16 - σ and 6 - π
(c) 26 - σ and 7 - π (d) 26 - σ and 6 - π

46. Methylamine reacts with HNO_2 to form?

(a) $\text{CH}_3 - \text{O} - \text{N} = \text{O}$ (b) $\text{CH}_3 - \text{OH}$
(c) $\text{CH}_3 - \text{O} - \text{CH}_3$ (d) $\text{CH}_3 - \text{CHO}$

47. Which statement is not correct for Glucose?

(a) When heated with HI it gives n -Hexane
(b) It is aldohexose
(c) It react with Hydroxyl amine
(d) It contain furanose structure

48. Which base is not present in the DNA structure?

- (a) Uracil (b) Adenine
(c) Guanine (d) Cytosine

49. What are two monomers of Glyptal polymer?

- (a) Ethylene Glycol and Isophthalic acid
(b) Ethane-1, 2-Diol and Phthalic acid
(c) Ethylene Glycol and Terephthalic acid
(d) Formaldehyde and Ethylene Glycol

50. Which polymer is used in making non-stick surface coated Utensils?

- (a) PHBV (b) Nylon 6,6
(c) Teflon (d) Buna - N

51. Which artificial sweetening agent is limited in for cold food and soft drinks?

- (a) Sucralose (b) Alitame
(c), Saccharin (d) Aspartame

52. Polyethylene-glycol is used in the preparation of which types of detergent?

- (a) Anionic detergent (b) Non- Ionic detergent
(c) Cationic detergent (d) Soap

53. The correct order of the packing efficiency in different types of unit cell is _____

- (a) fcc > bcc > simple cubic
(b) fcc < bcc < simple cubic
(c) fcc < bcc > simple cubic
(d) fcc = bcc > simple cubic

54. Which of the following defect obtained by heating of zinc-oxide?

- (a) Impurity defect
(b) Metal deficiency defect
(c) Stoichiometric defect'
(d) Metal excess defect

55. Which of the following aqueous solution has highest boiling point?

- (a) 0.1MKNO₃ (b) 0.1 M urea
(c) 0.1MK₄[Fe(CN)₆] (d) 0.1MNH₄NO₃

56. We have three aqueous solutions of NaCl labelled as 'A', 'B' and 'C' with concentrations 0.1M, 0.01M and 0.001 M respectively. The value of van't Hoff factor for these solutions will be in the order.

- (a) i_A = i_B = i_C (b) i_A > i_B > i_C
(c) i_A < i_B > i_C (d) i_A < i_B < i_C

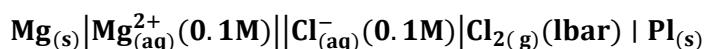
57. What is the osmotic pressure (π) of 0.02 M solution of NaCl?

- (a) 0.01 RT (b) 0.02 RT
(c) 0.04 RT (d) 0.002 RT

58. Resistance of a conductivity cell filled with 0.1MKCl_s solution is 100Ω and conductivity of solution is 1.29 s/m. Then what will be the value of conductivity cell constant.

- (a) 1.29 cm⁻¹ (b) 1.29 m₁⁻¹
(c) 1.24 cm⁻¹ (d) 0.248 m⁻¹

59. Which of the following is correct Nearst equation for the given electrochemical cell?



- (a). $E_{\text{cell}} = E_{\text{cell}}^0 - \frac{0.059}{2} \log \frac{[\text{Cl}^{-}]^2}{[\text{Mg}^{2+}]}$
(b) $E_{\text{cell}} = E_{\text{cell}}^0 - \frac{0.059}{2} \log \frac{[\text{Mg}^{2+}]}{[\text{Cl}^{-}]^2}$

$$(c) E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.059}{2} \log \frac{1}{[\text{Mg}^{2+}][\text{Cl}^{-}]^2}$$

$$(d) E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.059}{2} \log [\text{Mg}^{2+}][\text{Cl}^{-}]^2$$

60. Which of the following chemical reaction occur at anode during electrolysis of higher concentrated H_2SO_4 solution?

- (a) $2\text{SO}_4^{2-}(\text{aq}) \rightarrow \text{S}_2\text{O}_8^{2-}(\text{aq}) + 2\text{e}^{-}$
 (b) $2\text{H}_2\text{O}(\text{l}) \rightarrow \text{O}_2(\text{g}) + 4\text{H}^{+}(\text{aq}) + 4\text{e}^{-}$
 (c) $\text{H}_2\text{O}(\text{l}) + \text{e}^{-} \rightarrow \frac{1}{2}\text{H}_2(\text{g}) + 2\text{OH}^{-}(\text{aq})$
 (d) $\text{S}_2\text{O}_8^{2-}(\text{aq}) + 2\text{e}^{-} \rightarrow 2\text{SO}_4^{2-}(\text{aq})$

61. For which of the following graph of first order reaction the value of slope will be $K/2.303$?

- (a) $\log[\text{R}]_0/[\text{R}] \rightarrow t$ (Time)
 (b) $\log[\text{R}]/[\text{R}]_0 \rightarrow t$ (Time)
 (c) $\ln[\text{R}]_0/[\text{R}] \rightarrow t$ (Time)
 (d) $\ln[\text{R}]/[\text{R}]_0 \rightarrow t$ (Time)

62. Which will be the unit of rate constant for the reaction having Rate = $K[\text{A}]^{1/2}[\text{B}]^{3/2}$?

- (a) Second^{-1} (b) $\text{Mol/lit} \cdot \text{Sec}^{-1}$
 (c) $\text{Mol}^{-1} \cdot \text{lit} \cdot \text{Sec}^{-1}$ (d) $(\text{Mol/Lit})^2 \cdot \text{Sec}^{-1}$

63. A reaction is first order in terms of A and second order in terms of B. What will be the rate of reaction, if concentration of B is increased two times?

- (a) 4 -Times (b) 2-Times
 (c) 8-Times (d) 16-Times

64. Which of the following statement is incorrect for physisorption?

- (a) It arises because of Van der Waal's Force
 (b) It is reversible in nature
 (c) It is not specific in nature
 (d) High temperature is favourable for adsorption. It increases with increase in temperature

65. Which is correct order of flocculating power in the coagulation of As_2S_3 Sol?

- (a) $\text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{Cl}^{-}$
 (b) $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^{+}$
 (c) $\text{Al}^{3+} < \text{Ba}^{2+} < \text{Na}^{+}$
 (d) $\text{PO}_4^{3-} < \text{SO}_4^{2-} < \text{Cl}^{-}$

66. Mention percentage of Ag (Silver) in German silver alloy.

- (a) 20 – 30% (b) 10%
 (c) 0.0% (d) 40 – 50%

67. Which of the following ore is not in oxide form?

- (a) Malachite (b) Haematite
 (c) Magnetite (d) Zincite

68. By thermal decomposition of which of the following compound very pure dinitrogen gas can be obtained?

- (a) Ammonium dichromate
 (b) Ammonium Chloride
 (c) Sodium Azide
 (d) Barium Nitrate

69. Which of the following oxide show acidic property?

- (a) MnO_2 (b) MnO
 (c) Mn_2O_7 (d) Mn_2O_3

70. Which of the following are peroxo acids of Sulphur?

- (a) H_2SO_5 and $\text{H}_2\text{S}_2\text{O}_7$
 (b) H_2SO_5 and $\text{H}_2\text{S}_2\text{O}_8$
 (c) $\text{H}_2\text{S}_2\text{O}_7$ and $\text{H}_2\text{S}_2\text{O}_8$
 (d) $\text{H}_2\text{S}_2\text{O}_6$ and $\text{H}_2\text{S}_2\text{O}_7$

71. When alkaline KMnO_4 is treated with KI, Iodide ion is oxidised to ____

- (a) IO^- (b) I_2
 (c) IO_3^- (d) IO_4^-

72. In the electronic configuration of which of the following element-electron is arranged in 5d orbital?

- (a) ${}_{64}\text{Gd}$ (b) ${}_{63}\text{Eu}$
 (c) ${}_{65}\text{Tb}$ (d) ${}_{66}\text{Dy}$

73. What kind of isomerism exists between $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ and $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$?

- (a) Ionisation (b) - Solvate
 (c) Coordination (d) Linkage

74. If $\Delta_0 < P$, the correct electronic configuration for d^4 system will be:

- (a) $t_{2g}^2 e_g^2$ (b) $t_{2g}^4 e_g^0$
 (c) $t_{2g}^3 e_g^1$ (d) $t_{2g}^0 t_g^4$

75. Which of the following species is not expected to be a ligand?

- (a) NH_4^+ (b) NO
 (c) $\text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{NH}_2$ (d) CO

76. The following results are as under for the reaction $\text{S} + \text{Nu} \rightarrow \text{Product}$ by which reaction mechanism this reaction occurs?

Experiment	[S]	[Nu]	Rate $\left(\frac{\text{Concentration}}{\text{Time}}\right)$
1	0.1	0.1	2.2×10^{-3}
2	0.2	0.1	4.4×10^{-3}
3	0.1	0.2	4.4×10^{-3}

- (a) Electrophilic addition (b) $\text{S}_{\text{N}}\text{I}$
 (c) $\text{S}_{\text{N}}2$ (d) Electrophilic substitution

77. Which one is a reaction to prepare CCl_2F_2 (Freon-12) from CCl_4 ?

- (a) Wurtz Reaction (b) Finkelstein
 (c) Elimination Reaction (d) Swartz Reaction

78. How much gram of ethanol is required to obtain 280 ml dihydrogen at S.T.P. by reaction of $\text{C}_2\text{H}_5\text{OH}$ with Na-Metal? (Mol. wt. of ethanol = 46 g/mol).

- (a) 2.3 (b) 4.6
 (c) 1.15 (d) 0.575

79. Which product is obtained between reaction of CH_3ONa and $(\text{CH}_3)_3\text{CBr}$?

- (a) Only Ether (b) Only Alkene
 (c) Both alkene and ether (d) Alcohol

80. Which of the following alcohol undergo dehydration reaction with Cu (Copper) metal at 573 K temperature?

- (a) Secondary and Tertiary
 (b) Primary & Secondary

- (c) Primary and Tertiary
(d) Only Tertiary

Mathematics

81. $\begin{vmatrix} \sin \frac{11\pi}{36} & \cos \frac{11\pi}{36} \\ \sin \frac{2\pi}{9} & \cos \frac{2\pi}{9} \end{vmatrix} = \underline{\hspace{2cm}}$

- (a) $\cos \frac{\pi}{12}$ (b) $\sin \frac{2\pi}{9}$
(c) $\cos \frac{5\pi}{12}$ (d) $\sin \frac{7\pi}{12}$

82. If $A(K, 1)$, $B(2, 4)$ and $C(1, 1)$ are the vertices of the $\triangle ABC$, such that area of the $\triangle ABC$ is 6 unit, then $K = \underline{\hspace{2cm}}$

- (a) -5 and 3 (b) 5 and -3
(c) 3 and -1 (d) 5 and 3

83. $\left\{ \frac{d}{dx} (x^x + x^{x+1} + x^{x+2}) \right\}_{x=e} = \underline{\hspace{2cm}}$

- (a) $e^e(1 + e^2 + 2e)$ (b) $e^e(3e^2 + 2e + 2)$
(c) $e^e(2e^2 + 4e + 3)$ (d) $e^e(1 + 4e + 2e^2)$

84. If $x = a \cos \theta$, $y = a \sin \theta$, then $\frac{d^2y}{dx^2} = \underline{\hspace{2cm}}$ (where $a \neq 0$, $\theta \neq k\pi$, $k \in \mathbb{Z}$)

- (a) $-\frac{1}{a} \operatorname{cosec}^2 \theta \sec \theta$ (b) $\frac{1}{a} \cot^3 \theta$
(c) $\operatorname{cosec}^2 \theta$ (d) $-\frac{1}{a} \operatorname{cosec}^3 \theta$

85. If $y = \sqrt{\sin^{-1} x + y}$, then $\frac{dy}{dx} = \underline{\hspace{2cm}}$ (where $x \in (0, 1)$)

- (a) $\frac{1}{(2y-1)\sqrt{1-x^2}}$ (b) $\frac{1}{(1-2y)\sqrt{1-x^2}}$
(c) $\frac{1}{(2y-1)\sqrt{x^2-1}}$ (d) $\frac{1}{(2y+1)\sqrt{1-x^2}}$

86. For the function $f(x) = x + x^{-1}$, $x \in [1, 3]$, the value of C for mean value theorem is :

- (a) $\sqrt{3}$ (b) 1
(c) $\sqrt{2}$ (d) $\sqrt{5}$

87. Rate of change in the volume of a sphere of a radius r w.r.t. its diameter = $\underline{\hspace{2cm}}$

- (a) $4\pi r^2$ (b) $2\pi r^2$
(c) $2/3\pi r^2$ (d) $8\pi r^2$

88. Which of the following function is decreasing on $\left(0, \frac{\pi}{8}\right)$?

- (a) $\sin x$ (b) $-\cos x$
(c) $\cos 4x$ (d) $\tan 4x$

89. An approximate value of $(81.5)^{1/4}$ is:

- (a) 3.0436 (b) 3.0033
(c) 3.0046 (d) 3.0465

90. Equation of the normal to the curve $x^{2/3} + y^{2/3} = 2$ at $(1, 1)$ is :

- (a) $2x - y - 1 = 0$ (b) $x + y - 2 = 0$
(c) $x + y = 0$ (d) $x - y = 0$

91. If $\int \left\{ \cos^{-1} x - (1 - x^2)^{-1/2} \right\} K dx = K \cdot \cos^{-1} x + C$, then $K =$ ____

- (a) e^x (b) $-e^x$
(c) e^{-x} (d) $e^{\cos^{-1} x}$

92.

$$\int \frac{\tan x}{\cos x(\sec x - 1)(\sec x - 2)} dx = \dots + C.$$

- (a) $\log \left| \frac{\sec x - 2}{\sec x - 1} \right|$ (b) $\log \left| \frac{\sec x + 2}{\sec x - 1} \right|$
(c) $\log \left| \frac{\operatorname{cosec} x + 2}{\operatorname{cosec} x - 1} \right|$ (d) $\log \left| \frac{\cos x + 1}{\cos x - 2} \right|$

93. $\int x^{2019} \cdot e^{2020} dx = _ + C.$

- (a) $\frac{1}{2019} e^{x^{2019}}$ (b) $\frac{1}{2020} e^{x^{2019}}$
(c) $e^{x^{2020}}$ (d) $\frac{1}{2020} e^{x^{2020}}$

94. $\int_{x/6}^{x/3} \frac{1}{1 + \tan^4 x} dx =$ ____

- (a) $\pi/12$ (b) $\pi/4$
(c) $\pi/2$ (d) $\pi/6$

95. $\int_0^1 (0.001)^{x/3} \cdot e^x dx =$ ____

- (a) $\frac{10 - 10e}{(1 + \log_e 10)}$ (b) $\frac{10 - e}{e(1 - \log_e 10)}$
(c) $\frac{e - 10}{10(1 - \log_e 10)}$ (d) $\frac{e - 10}{10(1 + \log_{10} e)}$

96. Area of the region bounded by the ellipse $9x^2 + 4y^2 = 1$ in the first quadrant is:

- (a) $\pi/6$ (b) $\pi/24$
(c) $3\pi/2$ (d) 6π

97. Find the area of the region bounded by the line $y = 3 - x$, the X-axis and the ordinates $x = 2$ and $x = 5$.

- (a) 3 (b) $1/2$
(c) $5/2$ (d) $3/2$

98. Area of the region enclosed by the parabola $y = x^2$ and the line $y = x + 2$ is:

- (a) $9/2$ (b) $11/2$
(c) $5/2$ (d) $7/2$

99. The order and degree of the differential equation $\sqrt[4]{\left(\frac{d^3 y}{dx^3}\right)^5} = \sqrt[3]{\left(\frac{d^2 y}{dx^2}\right)^4}$ is :

- (a) 2 and 16 (b) 3 and 15
(c) 3 and 16 (d) 2 and 12

100. The integrating factor of the differential equation $\frac{dy}{dx} + y \tan x = \sec x$ is :

- (a) $\tan x$ (b) $e^{\sec x}$
(c) $\cos x$ (d) $\sec x$

101. Particular solution of the differential equation $\frac{dy}{dx} = -4xy^2$, Given that $y = 1$, where $x = 0$ is :

- (a) $y = \frac{1}{2x^2 + 1}$ (b) $x = \frac{1}{2y^2 + 1}$
(c) $y = 2x^2 + 1$ (d) $y = \frac{x}{2x^2 + 1}$

102. For any vector $\vec{a} \in \mathbb{R}^3$, $|\vec{a} \times \hat{i}|^2 + |\vec{a} \times \hat{j}|^2 + |\vec{a} \times \hat{k}|^2 = \underline{\hspace{2cm}}$
 (a) $2|\vec{a}|^2$ (b) $|\vec{a}|$
 (c) $|\vec{a}|^2$ (d) $3|\vec{a}|^2$
103. For the vectors $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$, $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b}) = \underline{\hspace{2cm}}$
 (a) 11 (b) -11
 (c) 5 (d) -5
104. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$ and $|\vec{b}| = \frac{\sqrt{2}}{3}$ and $\vec{a} \times \vec{b}$ is a unit vector, then the angle between $\vec{a}$ and $\vec{b}$ is:
 (a) $\pi/2$ (b) $\pi/3$
 (c) $\pi/6$ (d) $\pi/4$
105. Cartesian equation of the line through $(5, -2, 4)$ and which is parallel to the vector $3\hat{i} + 2\hat{j} - 8\hat{k}$ is :
 (a) $\frac{x-5}{3} = \frac{y+2}{2} = \frac{z-4}{-8}$ (b) $\frac{x-5}{3} = \frac{y-2}{2} = \frac{z+4}{-8}$
 (c) $\frac{x-3}{5} = \frac{y-2}{2} = \frac{z+8}{-4}$ (d) $\frac{x-3}{5} = \frac{y+2}{-2} = \frac{z+8}{4}$
106. If a, b and c are intercepts on X-axis, Y-axis and Z-axis respectively of the plane $x + 2y + 3z = 1$, then $2a + 4b + 3c = \underline{\hspace{2cm}}$
 (a) 19 (b) 5
 (c) 6 (d) 17
107. Measure of the angle between the line $\vec{r} = (-\hat{i} + 3\hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k}) (\lambda \in \mathbb{R})$ and the plane $10x + 2y - 11z = 3$ is :
 (a) $\pi/2$ (b) $\cos^{-1}(8/21)$
 (c) $\sin^{-1}(8/21)$ (d) $\sin^{-1}(1/21)$
108. The coordinates of the corner points of the bounded feasible region are $(0, 10), (5, 5), (15, 15)$ and $(0, 20)$. The maximum of the objective function $Z = 10x + 20y$ is:
 (a) 600 (b) 550
 (c) 400 (d) 450
109. Minimise objective function $z = 3x + 2y$ subject to the constraints:
 $x + y \geq 8, x + y \leq 5, x \geq 0, y \geq 0$ is:
 (a) 15
 (b) 6
 (c) 24
 (d) No feasible region and hence no feasible solution
110. For independent events A and B $P(A) = P$; $P(B) = \frac{1}{2}$ and $P(A \cup B) = 3/5$, then $P = \underline{\hspace{2cm}}$
 (a) $1/10$ (b) $1/5$
 (c) $1/2$ (d) $2/5$
111. If a fair coin is tossed 5 times, then the probability of getting exactly 3 heads is:
 (a) $5/16$ (b) $3/32$
 (c) $1/32$ (d) $5/32$
112. If the probability distribution of X is:

X	1	2	3	4	5	6
P(X)	1/6	1/6	1/6	1/6	1/6	1/6

then $\text{Var.}(X) = \underline{\hspace{2cm}}$

- (a) $91/6$ (b) $21/6$
 (c) $35/12$ (d) $35/3$

113. Relation R in the set $\{\pi, \pi^2, \pi^3\}$ defined by $R = \{(\pi, \pi), (\pi^2, \pi^2), (\pi^3, \pi^3), (\pi, \pi^2), (\pi^2, \pi^3)\}$ is :

- (a) Reflexive but neither symmetric nor transitive
- (b) Symmetric but neither reflexive nor transitive
- (c) Transitive but neither reflexive nor symmetric
- (d) Only symmetric and transitive

114. If $m * n = \frac{mn}{2}, \forall m, n \in \mathbb{Q}^+$, then $(4 * 3)^{-1} =$ __

- (a) $1/6$
- (b) $3/2$
- (c) 2
- (d) $2/3$

115. $\cos^{-1}\{\cot(\sum_{i=1}^3 \cot^{-1} i)\} =$ _____

- (a) 0
- (b) $\pi/2$
- (c) π
- (d) $-\pi/2$

116. $\cos(\sec^{-1} 2) + \tan(\cot^{-1} \sqrt{3}) + \sin(\operatorname{cosec}^{-1} \frac{2}{\sqrt{3}}) =$

- (a) $\frac{3+\sqrt{3}}{5\sqrt{3}}$
- (b) $\frac{7+\sqrt{3}}{5\sqrt{3}}$
- (c) $\frac{5+\sqrt{3}}{2\sqrt{3}}$
- (d) $\frac{7-\sqrt{3}}{2\sqrt{3}}$

117. If $\cos\left(\cos^{-1} \frac{\sqrt{3}}{2} + \sin^{-1} x\right) = 1$, then value of x is :

- (a) $-1/2$
- (b) $\sqrt{3}/2$
- (c) $-\sqrt{3}/2$
- (d) 0

118. If $\begin{bmatrix} x+y & -2 \\ 7+z & x-y \end{bmatrix} = \begin{bmatrix} -7 & -2 \\ 5 & 0 \end{bmatrix}$, then $2x + 4y + 2z =$ __

- (a) -9
- (b) 17
- (c) -25
- (d) -14

119. If $A = \begin{bmatrix} 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$, then $(BA)' =$ __

- (a) $\begin{bmatrix} 3 & 6 \\ 4 & 8 \end{bmatrix}$
- (b) $\begin{bmatrix} 3 & 4 \\ 6 & 8 \end{bmatrix}$
- (c) $\begin{bmatrix} 4 & 8 \\ 6 & 3 \end{bmatrix}$
- (d) $[11]$

120. If $A = \begin{bmatrix} 0 & 0 & -5 \\ 0 & -5 & 0 \\ -5 & 0 & 0 \end{bmatrix}$, then $A^2 =$

- (a) $-5 I_3$
- (b) $5 A$
- (c) $25 A$
- (d) $25 I$

Biology

121. Alexander Fleming was the first person to discover 'Penicillin' by chance. He worked on which bacterium?

- (a) Haemophilus Influenzac
- (b) Staphylococci
- (c) Streptococcus Pneumoniae
- (d) Salmonella Typhi

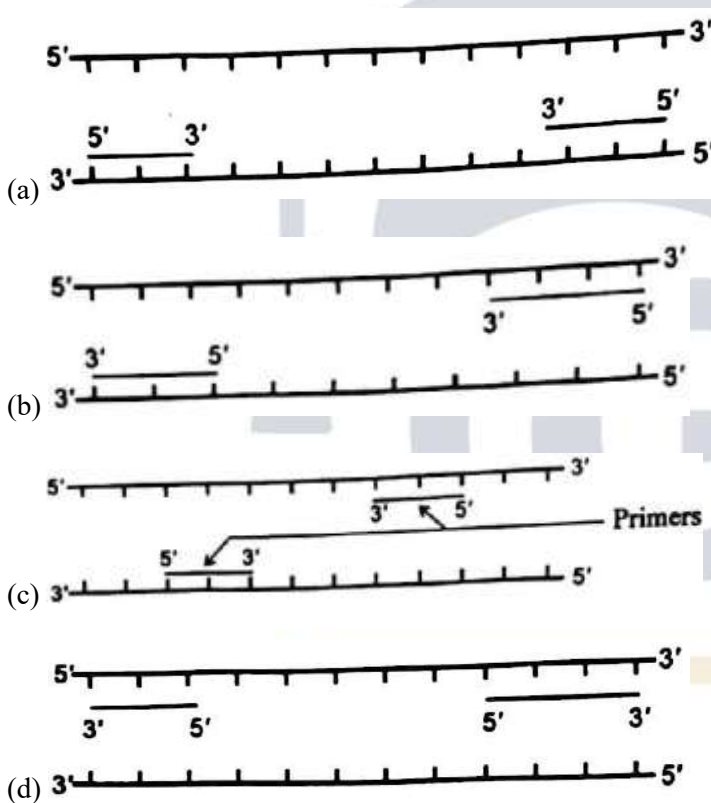
122. Match the following. Choose the correct option.

	Column - I		Column - II

(i)	Propionibacterium Shermanii	(P)	Fermenting fruit prices to produce ethnlol
(ii)	Saccharomyces Cerevisiae	(Q)	Citric Acid
(iii)	Aspergillus niger	(R)	'Swiss Cheese'
(iv)	Trichoderma polysporum	(S)	Immuno-suppressive

- (a) (i - R); (ii - Q); (iii - P); (iv - S)
 (b) (i - P); (ii - S); (ii - R); (iv - Q)
 (c) (i - P); (ii - Q); (iii - R); (iv - S)
 (d) (i - R); (ii - P); (iii - Q); (iv - S)

123. Choose the correct option for the 'Annealing' step in P.C.R. from the following diagrammatic representations:



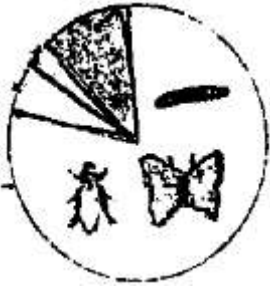
124. In extraction of genetic material (DNA), which enzyme is not used?

- (a) Ribonuclease
 (b) Cellulose
 (c) Protease
 (d) Both Protease and Ribonuclease

125. In E. Coli cloning vector pBR322, antibiotic resistance genes (amp^k) indicates which restriction sites?

- (a) PvuI, PstI
 (b) PvuII, EcoRI
 (c) BamHI, Sall
 (d) EcoRI, Hind III

126. Proteins encoded by the genes bollworms. ____ and ____ which control the cotton bollworms
- Cry I Ab and Cry I Ac.
 - Cry I Ab and Cry II Ac.
 - Cry I Ac and Cry II Ab.
 - Cry II Ab and Cry II Ac.
127. Choose the correct option from the statements given below which do not support the reasons for production of transgenic animals :
- to test the safety of the polio vaccine
 - for production of $\alpha - 1$ antitrypsin used to treat emphysema
 - for diagnosing genetic disorder
 - to test the toxicity of drugs
128. Choose the correct option showing population interactions
- Sea-anemone and clown fish $\rightarrow$ Predation
 - Monarch butterfly and bird $\rightarrow$ Competition
 - Egret and grazing cattle $\rightarrow$ Parasitism
 - Fig and wasp $\rightarrow$ Mutualism
129. ____ and ____ are the two basic processes which contribute to an increase in population density.
- Natality and Immigration
 - Mortality and Immigration
 - Mortality and Emigration
 - Natality and Emigration
130. A few organisms can tolerate and thrive in a wide range at temperatures. They are known as:
- Eurythermal
 - Stenohaline
 - Stenothermal
 - Euryhaline
131. In a particular condition, decomposition rate is slower if detritus is rich in ____ and ____
- nitrogen and sugar
 - lignin and chitin
 - lignin and nitrogen
 - chitin and sugar
132. In which trophic level, you will keep the species 'Sparrow'?
- Only Primary Consumer
 - Only Secondary Consumer
 - Both Primary and Secondary Consumer
 - Both Secondary and Tertiary Consumer
133. Cryopreservation technique are practiced for preserving the gametes of threatened species in viable and fertile condition for long periods. Choose the correct temperature in which it is done?
- -296°C
 - -42°C
 - -90°C
 - -196°C
134. In species-Area relationship, select the naturalist and geographer who observed that within a region species richness increased with increasing explored area, but only up to a limit.
- Paul Ehrlich
 - Alexander Von Humboldt
 - Edward Wilson
 - David Tilman
135. Following figure represent the global biodiversity showing proportionate number of species at major taxa of invertebrates. Identify 'X' and 'Y'.



- (a) X = Molluscs; Y = Crustaceans
 (b) X = Crustaceans; Y = Molluscs
 (c) X = Crustaceans; Y = Insects
 (d) X = Molluscs; Y = Insects

136. According to Central Pollution Control Board (CPCB), particulate size ____ diameter are responsible for Causing the greatest harm to human health.

- (a) 10.0 micrometers (b) 5.0 micrometers
 (c) 2.5 micrometers (d) 7.5 micrometers

137. Choose the correct option by matching Column - I and Column - II

	Column - I		Column - II
(P)	Water (Prevention and Control of Pollution) Act,	(i)	1987
(Q)	Environment (Protection) Act,	(ii)	1981
(R)	Montreal Protocol	(iii)	1974
(S)	Air (Prevention and Control of Pollution) Act,	(iv)	1986

- (a) (P - iii), (Q - iv), (R - i), (S - ii)
 (b) (P - iii), (Q - i), (R - iv), (S - ii)
 (c) (P - ii), (Q - iii), (R - iv), (S - i)
 (d) (P - iv), (Q - iii), (R - ii), (S - i)

138. Choose the correct option which is correct for 'asexual reproduction'.

Statement P: - Reproductive structures for Chlamydomonas are zoospores.

Statement Q :- Amoeba undergoes both binary and multiple fission under respective conditions.

Statement R: - Fragmentation occurs in Hydra & sponges.

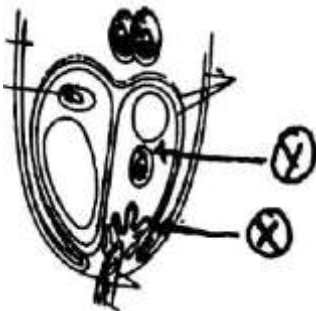
- (a) Statements P is true
 (b) Statements Q and R are true
 (c) Statements P and Q are true
 (d) Statements P, Q & R are true

139. Match the following. Choose the correct option.

	Column - I	Column - II		Column - III	
(i)	Homothallic	(P)	Monoecious	(X)	Coconut & Chara
(ii)	Heterothallic	(Q)	Dioecious	(Y)	Papaya & Merchantia

- (a) (I - ii), (II - Q), (III - X)
 (b) (I - i), (II - P), (III - X)
 (c) (I - i), (II - P), (III - Y)
 (d) (I - i), (II - Q), (III - Y)

140. What indicates 'X' and 'Y' in the following diagram?

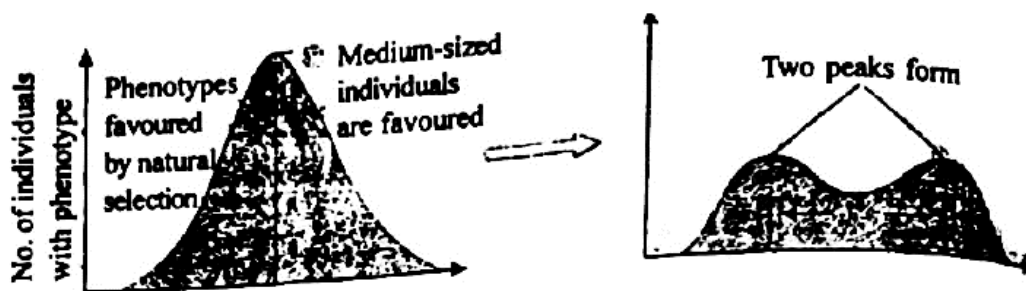


- (a) X = Egg cell ; Y = Synergid
 (b) X = Synergid ; Y = Filiform apparatus
 (c) X = Filiform apparatus; Y = Synergid
 (d) X = Egg cell; Y = Filiform apparatus

141. In flowering plants, 'triple fusion' is the combination of ____

- (a) Central polar nuclei + One male gamete
 (b) Two antipodal cells + One male gamete
 (c) Two synergids + One male gamete
 (d) Egg cell + Two male gametes

142. The diagram given below represent the operation of natural selection on difference trails. Choose the correct option.

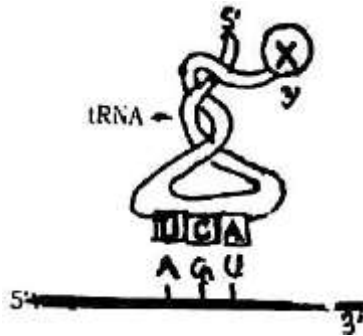


- (a) Disruptive
 (b) Directional
 (c) Stabilising
 (d) Stabilising & Directional Both

143. This defines the 'Operon'.

- (a) Arrangement of operator + regulatory gene
 (b) Arrangement of structural gene + operator + regulatory gene
 (c) Arrangement of structural gene + regulatory gene
 (d) Arrangement of structural gene + promoter + regulatory gene

144. In a microsporangium, which layer is generally having more than one nucleus?
 (a) Tapetum (b) Middle layers
 (c) Endothecium (d) Epidermis
145. Choose the correct sequence of transport at sperms in human from seminiferous tubules is :
 (a) Vasa efferentia → Rete testis → Epididymis → Vas deferens
 (b) Rete testis → Epididymis → Vasa efferentia → Vas deferens
 (c) Rete testis → Vasa efferentia → Epididymis → Vas deferens
 (d) Vas deferens → Vasa efferentia → Epididymis → Rete testis
146. These hormones are produced in women during pregnancy only:
 (a) hCG progestogens & relaxin
 (b) hCG hPL & relaxin
 (c) hPL, estrogen & relaxin
 (d) progestogens, estrogens & relaxin
147. During Human fertilisation, this induces changes and acts as a barrier and ensure that only one sperm can enter and fertilise the ovum.
 (a) Perivitelline space (b) Zona pellucida
 (c) Corona radiata (d) Cytoplasm of the ovum
148. In females, MTP's are considered relatively safe during ____ weeks of pregnancy.
 (a) 30 to 36 (b) 12 to 24
 (c) 16 to 28 (d) 11 to 22
149. Choose the correct option which can be used by the females as injections or implants under the skin for emergency contraceptive from the following:
 (i) progestogens
 (ii) progestogen + estrogen combinations
 (iii) estrogen
 (iv) progestasert
 (a) (i) & (ii) (b) (ii) & (iii)
 (c) (i) & (iv) (d) (i) & (iii)
150. 'Sex-determination' in Humans is identified by:
 (a) Somatic cell → autosomes
 (b) Germ cell → sex chromosome
 (c) Germ cell → autosomes
 (d) Somatic cell → sex chromosomes
151. In Turner's Syndrome, during cell division, which type of Aneuploidy is seen?
 (a) $(2n + 2)$ (b) $(2n - 1)$
 (c) $(2n + 1)$ (d) $(2n - 2)$
152. In Turner's Syndrome, during cell division, which type of Aneuploidy is seem?
 (a) $(2n + 2)$ (b) $(2n - 1)$
 (c) $(2n + 1)$ (d) $(2n - 2)$
153. In the given figure below, what does the ' X ' represents?



- (a) Glycine (Gly) (b) Tyrosine (Tyr)
(c) Valine (Val) (d) Serine (Ser)

154. (i) The Codon is read in t RNA in a contiguous fashion. There is no punctuations.

(ii) Some amino acids are coded by more than one codon.

(iii) UUU would code for phenylalanine.

(iv) GAA is a stop terminator codon

Comparing the above statements (i - iv) select the correct option marked with T (True) & F (False) w.r.t. salient features of genetic code.

- (a) FTTF (b) FFTF
(c) TTFF (d) FTFT

155. From 15 mya to 40,000 years back, what will be the correct series of indication in evolution of man?

- (a) Australopithecines → Homo erectus → Ramapithecus → Neanderthal
(b) Ramapithecus → Homo erectus → Australopithecines → Neanderthal
(c) Australopithecines → Ramapithecus → Homo erectus → Neanderthal
(d) Ramapithecus → Australopithecines → Homo erectus → Neanderthal

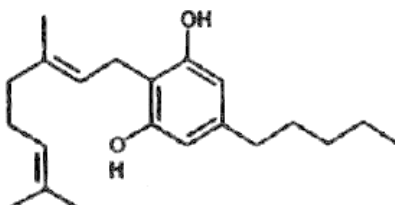
156. In the life cycle of plasmodium sporozoites ____ undergoes asexual reproduction in which cells?

- (a) Intestinal cells & R.B.C.
(b) Liver cells & R.B.C.
(c) Liver cells & W.B.C.
(d) Salivary glands & W.B.C.

157. This is the correct statement for IgE.

- (a) Inhibits the secretion of histamine and serotonin from mast cells
(b) Does not stimulate B cells
(c) Giving immune response to allergens
(d) This antibody is received from the mother to the foetus through placenta during pregnancy

158. Identify the plant, from where a chemical is extracted whose skeletal structure is given below.



- (a) Saccharum officinarum (b) Papaver somniferum
(c) Cannabis sativa (d) Eichhornia crassipes

159. Choose the correct option, which is not true for 'inbreeding depression.

- (a) In breeding refers to the mating of more closely related individuals within the same breed for 4-6 generations which lead to 'inbreeding depression'
(b) It increases homozygosity

- (c) Close inbreeding reduces fertility and productivity
- (d) It is a practice of mating animals within the same breed but having no common ancestors on either side of their pedigree up to 4-6 generations.

160. From IR-8 and Taichung Native -I, which variety of semi-dwarf crop was derived?

- (a) Sugarcane (b) Rice
- (c) Wheat (d) Maize

