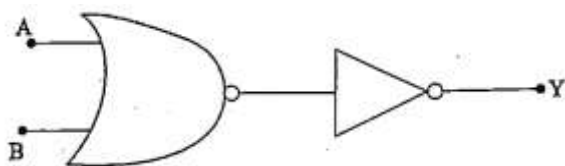


Physics

- For LCR ac series circuits, $L = 25\text{mH}$, $R = 3\Omega$, $C = 62.5\mu\text{F}$. What is the frequency of the sources at which resonance occurs?
 (a) 127.39 Hz (b) 35.40 Hz
 (c) 100 Hz (d) 21 Hz
- For a series LCR circuit with $L = 2\text{H}$, $C = 18\mu\text{F}$ and $R = 10\Omega$. What is the value Q-factor of this circuit?
 (a) 22.22 (b) 55.55
 (c) 44.44 (d) 33.33
- What is Range of Radio Frequency Band of FM (Frequency Modulated Band)?
 (a) 500 kHz to 1000 MHz
 (b) 54 MHz to 890 MHz
 (c) 530 kHz to 1710 kHz
 (d) 88 MHz to 108 MHz
- A plane electromagnetic wave of frequency 25 MHz travels in free space along the X-direction. At a particular point in space and time, where $\vec{B} = 2.1 \times 10^{-8} \hat{k} \text{T}$ then find $\vec{E}$ at this point?
 (a) $-2.1 \hat{j} \frac{\text{V}}{\text{m}}$ (b) $6.3 \hat{j} \text{V}$
 (c) $4.2 \hat{j} \frac{\text{V}}{\text{m}}$ (d) $-3.2 \hat{j} \frac{\text{V}}{\text{m}}$
- Glass prism having a refractive index μ , placed in a air, for that angle of minimum deviation of prism is same as angle of prism. Then what is value of angle of prism?
 (a) $2\cos^{-1}(\mu/2)$ (b) $2\cos^{-1}(\mu)$
 (c) $\cos^{-1}(\mu/2)$ (d) $\cos^{-1}(\mu)$
- The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. Its focal length is 12 cm. What is the refractive index of material of lens?
 (a) 1.33 (b) 1.62
 (c) 1.50 (d) 2.42
- Find equivalent focal length due to combination of two convex lens are in contact having a focal length both of them 30 cm.
 (a) 15 cm (b) 30 cm
 (c) 20 cm (d) 40 cm
- A tank is filled with water to a height of 16 cm . Find the apparent depth of a needle lying at the bottom of the tank is measured by a microscope. Refractive index of water (μ_w) is $4/3$.
 (a) 9.4 cm (b) 12.0 cm
 (c) 10.6 cm (d) 8.0 cm
- Estimate the distance for which ray optics is good approximation for an aperture of 5 mm and wavelength 500 nm?
 (a) 40 m (b) 30 m
 (c) 50 m (d) 20 m
- The wavelength of light 500 nm is used in a Young's double-slit experiment. The distance between the slits and screen is 100 cm and the slits are separated by 1 mm. Then find distance between fifth (5^{th}) and third (3^{rd}) bright fringes.
 (a) 1 mm (b) 3 mm
 (c) 2 mm (d) 4 mm
- Which of those metal having least work function (ϕ_0) among them?
 (a) Mo (b) Pb
 (c) Ca (d) Na

12. What is the de-Broglie wavelength associated with an electron, accelerated through a potential difference of 64 volts? [$h = 6.63 \times 10^{-34} \text{ J.s}$]
- (a) $1.23 \text{ \AA}$ (b) $1.87 \text{ \AA}$
(c) $1.53 \text{ \AA}$ (d) $1.98 \text{ \AA}$
13. In photoelectrical effect, that the graph of stopping potential (V_0) versus frequency ν is straight line. What will be the slope of this straight line?
- (a) $\frac{e}{h}$ (b) V_0/e
(c) h/e (d) $\frac{\nu}{h}$
14. What is the shortest wavelength present in the Balmer series of spectral line? [Where R is Rydberg constant]
- (a) $\frac{1}{R}$ (b) $\frac{3}{R}$
(c) $\frac{2}{R}$ (d) $\frac{4}{R}$
15. The radius of the innermost electron orbit of a hydrogen atom is $5.3 \times 10^{-11} \text{ m}$. What are the radii of the $n = 4$ orbit?
- (a) $2.12 \times 10^{-10} \text{ m}$ (b) $8.48 \times 10^{-10} \text{ m}$
(c) $4.24 \times 10^{-10} \text{ m}$ (d) $10.6 \times 10^{-10} \text{ m}$
16. The ground state energy of hydrogen atom is -13.6 eV . What will be the kinetic energies of the electron?
- (a) 13.6 eV (b) 27.2 eV
(c) -13.6 eV (d) -27.2 eV
17. How many neutrons will produced for a given following nuclear fission reaction? ${}_0^1\text{n} + {}_{92}^{235}\text{U} \rightarrow {}_{92}^{236}\text{U} \rightarrow {}_{56}^{144}\text{Ba} + {}_{36}^{89}\text{Kr} + (?) {}_0^1\text{n}$
- (a) 1 (b) 3
(c) 2 (d) 4
18. Half-life time of a radioactive element is 16 years. How much time will taken to reduce its activity 16 part?
- (a) 8 years (b) 32 years
(c) 16 years (d) 64 years
19. What should be the ratio of neutron and proton for stability of heavy nucleus?
- (a) 1:1 (b) 3:2
(c) 2:1 (d) 2:3
20. What is energy band gap (E_g) for p-type and n-type semiconductor use to form a LED to produce a red light colour?
- (a) 3 eV (b) 1.9 eV
(c) 1.8 eV (d) 1.4 eV
21. In full wave rectification Input Frequency 60 Hz. What will the output frequency for that?
- (a) 50 Hz (b) 100 Hz
(c) 60 Hz (d) 120 Hz
22. In a given following electronic logic circuit it behaves at which logic operation.



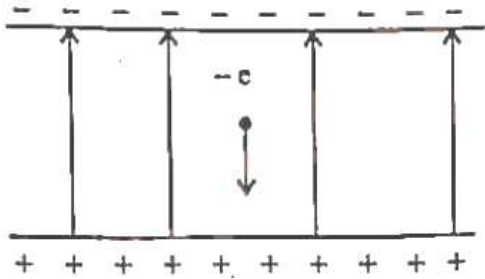
- (a) AND gate (b) NOT gate
(c) OR gate (d) NAND gate

23. Electrical field intensity due to an electric dipole on it's axis at distance $x(x > a)$ and on the equatorial at distance $y(y > a)$ are same. What is the ratio of x and y ?

- (a) $\sqrt[3]{2}:1$ (b) $\sqrt{2}:1$
(c) $1:\sqrt[3]{2}$ (d) $1:2$

24. As shown in the following fig. an electron falls through a distance of 1.5 cm in a uniform electric field of magnitude $2.0 \times 10^4 \text{ NC}^{-1}$. Find the acceleration of the electron due to the electric field.

$[e = 1.6 \times 10^{-19} \text{ C}, m_e = 9.1 \times 10^{-31} \text{ kg}]$



- (a) $2.90 \times 10^{19} \text{ ms}^{-2}$ (b) $1.67 \times 10^{27} \text{ ms}^{-2}$
(c) $3.52 \times 10^{15} \text{ ms}^{-2}$ (d) $6.62 \times 10^{34} \text{ ms}^{-2}$

25. Two large, thin metal plates are parallel and close to each other. On their inne faces, the plates have surface charge densities of same signs and of magnitude $17.7 \times 10^{-22} \text{ C/m}^2$. What is E in the outer region of the second plate?

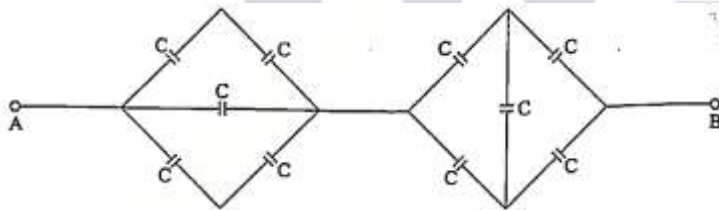
- (a) $4 \times 10^{-10} \text{ NC}^{-1}$ (b) $2 \times 10^{-10} \text{ NC}^{-1}$
(c) $1 \times 10^{-10} \text{ NC}^{-1}$ (d) Zero

26. Which of the following option gives the Dimensional Formula of Electrical Potential?

- (a) $[M^{-1} L^2 T^{-3} A^1]$ (b) $[M^0 L^3 T^3 A^{-1}]$
(c) $[M^{-1} L^{-2} T^{-4} A^2]$ (d) $[M^1 L^2 T^{-3} A^{-1}]$

27. Find the equivalent capacitance between two points A&B, for given figure (electric circuit)

[Capacitance of each capacitor is $C = 3\mu\text{F}$]

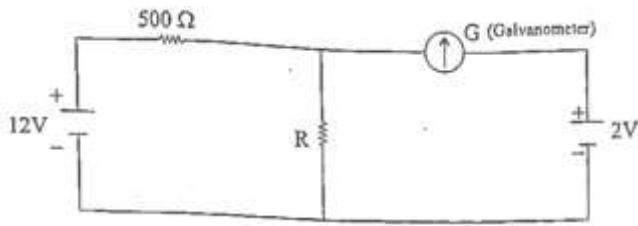


- (a) $1\mu\text{F}$ (b) $3\mu\text{F}$
(c) $2\mu\text{F}$ (d) $4\mu\text{F}$

28. Which of the following option is the pair of polar molecules?

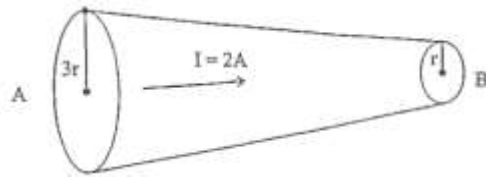
- (a) $[\text{H}_2\text{O}, \text{O}_2]$ (b) $[\text{HCl}, \text{H}_2]$
(c) $[\text{HCl}, \text{H}_2\text{O}]$ (d) $[\text{H}_2, \text{O}_2]$

29. For the which value of Resistance $R =$ when galvanometer shows zero deflection for following below electrical circuit.



- (a) 100Ω (b) 300Ω
(c) 200Ω (d) 400Ω

30. As following figure 2 A current passing through a conducting wire, radius of cross sectional of wire at point A is $3r$ and point B is r respectively. Then find the ratio of drift velocity at point A & B.



- (a) $\frac{1}{3}$ (b) 3
(c) $\frac{1}{9}$ (d) 9

31. In a potentiometer arrangement, a cell of emf 1.5 V gives a Balance point at 150 cm length of the wire. If the cell is replaced by another cell and the balance point shift to 210 cm, what is the emf of the second cell?

- (a) 3.2 V (b) 1.2 V
(c) 4.4 V (d) 2.1 V

32. Circular loop having radius r , carrying current J , produces magnetic field at the centre loop is B . What will be the magnetic dipole moment of this loop?

- (a) $\frac{4\pi Br r^3}{\mu_0}$ (b) $\frac{2\pi Br r^3}{\mu_0}$
(c) $\frac{\pi Br r^3}{\mu_0}$ (d) $\frac{\pi Br r^3}{4\mu_0}$

33. The horizontal component of the earth's magnetic field at a certain place is 3.0×10^{-5} T and the direction of the field is from the geographic south to the geographic north. A very long straight conductor is carrying a steady current of 2 A. What is the force per unit length on it when it is placed on a horizontal table and the direction of the current is cast to west?

- (a) 3×10^{-5} N/m (b) 9×10^{-5} N/m
(c) 6×10^{-5} N/m (d) 2×10^{-5} N/m

34. A solenoid of length 0.5 m has a radius of 1 cm and is made up of 1000 turns. It carries a current of 10 A. What is the magnitude of the magnetic field inside the solenoid?

- (a) 6.28×10^{-3} T (b) 2.51×10^{-2} T
(c) 1.71×10^{-2} T (d) 7.23×10^{-3} T

35. At certain place on the surface of the earth, horizontal component of earth's magnetic field is same as vertical component of earth magnetic field, then what will be angle of dip at that place?

- (a) 30° (b) 60°
(c) 45° (d) 90°

36. What is the magnitude of the equatorial fields due to a bar magnet of length 5.0 cm at a distance 75 cm from its mid -point? The magnetic moment of the bar magnet is 0.75 Am^2

- (a) 3.2×10^{-7} T (b) 1.78×10^{-7} T
(c) 6.4×10^{-7} T (d) 3.56×10^{-7} T

37. For a long current carrying solenoid having inside magnetic field is 0.6 T. Then find the magnetic energy per unit volume is ____

- (a) $1.43 \times 10^5 \text{ J/m}^3$ (b) $5.23 \times 10^4 \text{ J/m}^3$
(c) $2.86 \times 10^4 \text{ J/m}^3$ (d) Zero

38. The self-inductance L of a solenoid of length l and area of cross-section A increase ____ . (Here, with fixed number of turns N).

- (a) l and A increase
(b) l increases and A decreases
(c) l decreases and A increases
(d) Both l and A decrease

39. A pair of adjacent coils has a mutual inductance of 1.5 H. If the current in one coil changes from 0 to 20 A in 0.5 sec. what is the change of flux linkage with the other coil?

- (a) 15 Wb (b) 45 Wb
(c) 30 Wb (d) 60 Wb

40. A $50\mu\text{F}$ capacitor is connected to a 110 V, 60 Hz ac supply. Determine the rms value of the current in the circuit.

- (a) 5.2 A (b) 2.5 A
(c) 3.8 A (d) 2.1 A

Chemistry

41. Which halogen element gives Halous acid type of oxoacid?

- (a) F (b) Br
(c) Cl (d) I

42. Which is used for manufacture of steel?

- (a) Dihydrogen (b) Dinitrogen
(c) Dioxygen (d) Dichlorine

43. If atomic number of element is 26, then magnetic moment is ____ BM of its divalent aqueous ion?

- (a) 1.73 (b) 3.87
(c) 2.83 (d) 4.90

44. Which product is obtained during reaction of MnO_4^- with Γ in faintly alkaline condition?

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

45. Which is not act as ligand?

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

46. Which is correct formula for pentaaminecarbonatocobalt (III) chloride coordination compound?

- (a) $[\text{Co}(\text{NH}_3)_5(\text{CO}_3)]\text{Cl}$
(b) $[\text{Co}(\text{NH}_3)_5(\text{CO}_2)]\text{Cl}$
(c) $[\text{Co}(\text{NH}_3)_5(\text{CO}_3)]\text{Cl}_2$
(d) $[\text{Co}(\text{NH}_2)_5(\text{CO}_3)]\text{Cl}$

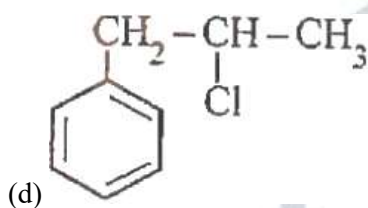
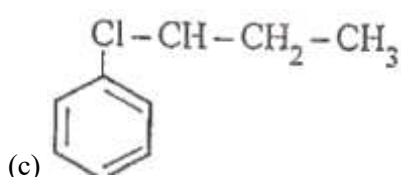
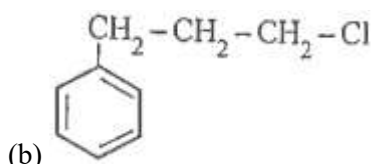
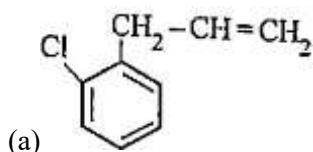
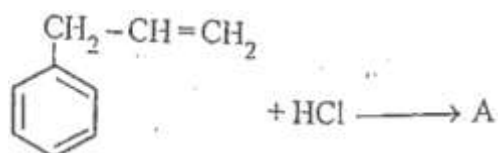
47. Which type of Isomerism in isomers $[\text{Co}(\text{NH}_3)_5(\text{SO}_4)]\text{Br}$ and $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$?

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

48. $\text{CH}_3\text{CH} = \text{CHCl}(\text{CH}_3)_2$ is which type of halide based on position of -Cl?

- (a) Allylic (b) Secondary
(c) Vinylic (d) Aryl

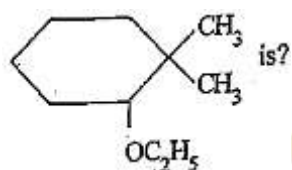
49. What is A in following reaction?



50. Which would undergo $\text{S}_\text{N}1$ reaction faster from following?

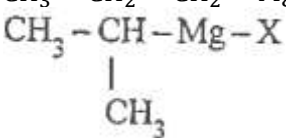
- (a) Chloromethane
- (b) 2-bromo-3-methylbutane
- (c) 2-chloro-3-methylbutane
- (d) 2-bromo-2-methylpropane

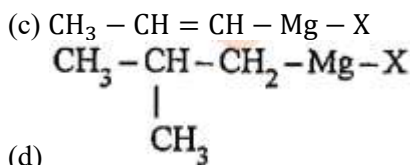
51. From following, IUPAC name of compound



- (a) 2-ethoxy-1, 1-dimethyl cyclohexane
- (b) 5-ethoxy-6, 6-dimethyl cyclohexane
- (c) 1-ethoxy-2,2-dimethyl cyclohexane
- (d) 1-ethoxy-6,6-dimethyl cyclohexane

52. Which Grignard reagent gives 2-methylpropan-1-ol with reaction with methanal?

- (a) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{Mg} - \text{X}$
- (b) 



(d)

53. Which compound having maximum value of pKa from following?

- (a) o - O₂ N - C₆H₄ - OH (b) p - O₂ N - C₆H₄ - OH
 (c) m - O₂ N - C₆H₄ - OH (d) C₆H₅OH

54. Which reagent is used to convert Allyl alcohol to propenal?

- (a) PCC (b) O₃/H₂O - Zn (Powder)
 (c) DIBAL-H (d) All above

55. Which compound give Cannizzaro reaction from following?

- (a) CH₃CHO (b) CH₂ClCHO
 (c) CCl₃CHO (d) CHCl₂CHO

56. Which compound having maximum acidic strength of the following?

- (a) 4-methoxy benzoic acid
 (b) 2-methoxy benzoic acid
 (c) Benzoic acid
 (d) 4-nitrobenzoic acid

57. 2° - Amine is obtained by reduction of which compound?

- (a) Nitrile (b) Nitro
 (c) Isonitrile (d) Amide

58. Hinsberg's reagent do not react with which amine?

- (a) Only 1°-amine (b) Only 3° - amine
 (c) Only 2° - amine (d) 1° and 2° - amine

59. Which product is obtained by nitration of aniline?

- (a) o-nitroaniline (b) m-nitroaniline
 (c) p-nitroaniline (d) All above

60. Which reaction prove that all the six carbon atoms are linked in a straight chain in glucose?

- (a) Heat with HI (b) Reaction with Br₂
 (c) Reaction with NH₂OH (d) Reaction with HCN

61. Which α-amino acid is not optical isomer?

- (a) Alanine (b) Glycine
 (c) Lysine (d) Leucine

62. In DNA, which bases is not present of following?

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

63. Which is network solid from following?

- (a) SiC (b) I_{2(s)}
 (c) CO_{2(s)} (d) H₂O_(s)

64. The edge lengths of the unit cells in terms of the radius r of spheres constitutin fcc , bcc and simple cubic unit cell are respectively _____

- (a) $\frac{4r}{\sqrt{3}}$, $2\sqrt{2}r$, $2r$ (b) $2r$, $2\sqrt{2}r$, $\frac{4r}{\sqrt{3}}$
 (c) $2r$, $\frac{4r}{\sqrt{3}}$, $2\sqrt{2}r$ (d) $2\sqrt{2}r$, $\frac{4r}{\sqrt{3}}$, $2r$

65. Atoms of element X form hcp lattice and those of the element Y occupy 75% of tetrahedral voids. What is the formula of the compound formed by elements X and Y?

- (a) X_4Y_3 (b) X_3Y_4
(c) X_2Y_3 (d) X_3Y_2

66. Which of the following aqueous solutions should have the minimum boiling point?

- (a) 0.1 M Urea (b) 0.1M K_2SO_4
(c) 0.1 M NaCl (d) 0.1M $FeCl_3$

67. 3.0-gram ethanoic acid in 50-gram benzene having ____ molality? (Atomic weights: H = 1, C = 12, O = 16).

- (a) 0.1 (b) 1.0
(c) 0.6 (d) 0.06

68. Which method is used to remove salts from sea water?

- (a) Hydraulic washing (b) Leaching
(c) Reverse osmosis (d) Froth Floatation

69. Which products are obtained during electrolysis of aqueous solution of sodium chloride?

- (a) NaOH, O_2 and H_2 (b) NaOH, Na and H_2
(c) NaOH, Cl_2 and H_2 (d) Na, Cl_2 and H_2

70. Using the data given below find out the strongest reducing agent?

$$E_{C_2O_7^{2-}/Cr^{3+}}^0 = 1.33 \text{ V}$$

$$E_{Cl_2/Cl^-}^0 = 1.36 \text{ V}$$

$$E_{MnO_4^-/Mn^{2+}}^0 = 1.51 \text{ V}$$

$$E_{Cr^{3+}/Cr}^0 = -0.74 \text{ V}$$

- (a) Cl^- (b) Cr^{3+}
(c) Cr (d) Mn^{2+}

71. Which is symbolic representation for following cell reaction, $Mg_{(s)} + Cl_{2(g)} \rightarrow Mg_{(aq)}^{2+} + 2Cl_{(aq)}^-$.

- (a) $Mg|Mg_{(aq)}^{2+}(1M)||Cl_{(aq)}^-(1M)|Cl_{2(g)}(1bar)|Pt$
(b) $Pt|Cl_{(aq)}^-(1M)|Cl_{2(g)}(1bar)||Mg_{(aq)}^{2+}(1M)|Mg$
(c) $Mg|Mg_{(aq)}^{2+}(1M)||Cl_{2(g)}(1bar)|Cl_{(aq)}^-(1M)|Pt$
(d) $Pt|Cl_{2(g)}(1bar)|Cl_{(aq)}^-(1M)||Mg_{(aq)}^{2+}(1M)|Mg$

72. For a reaction, $K = 4.5 \times 10^{-4} \text{ L mol}^{-1} \text{ s}^{-1}$. What is order of reaction?

- (a) Zero (b) Second
(c) First (d) Third

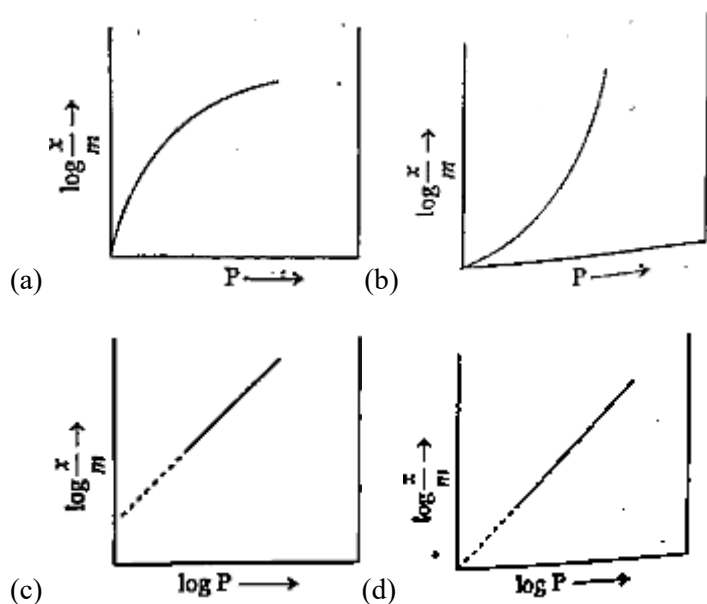
73. For first order reaction, the value of slope for graph of $\log \frac{[R]_0}{[R]} \rightarrow t$ is ____

- (a) $\frac{K}{2.303}$ (b) $\frac{2.303}{K}$
(c) -K (d) $-\frac{K}{2.303}$

74. The rate constant for a first order reaction is 60 s^{-1} . How much second will it take to reduce the initial concentration of the reactant to its $\frac{1}{16}$ th value?

- (a) 2.3×10^{-2} (b) 9.5×10^{-2}
(c) 4.6×10^{-2} (d) 6.9×10^{-2}

75. Which is Freundlich Adsorption isotherm?



76. Which method is used to prepare colloids?



- (a) Oxidation (b) Hydrolysis
(c) Reduction (d) Double decomposition

77. Which of the following ions will have maximum flocculating power for coagulation of As_2S_3 sol?

- (a) Na^+ (b) Al^{3+}
(c) Mg^{2+} (d) Ba^{2+}

78. Which metals are purified by vapour phase refining for following?

- (a) Ni, Fe (b) Zr, Sn
(c) Ag, Ni (d) Ni, Zr

79. Copper matte is a mixture of which substances?

- (a) $\text{Cu}_2\text{O} + \text{FeS}$ (b) $\text{Cu}_2\text{S} + \text{FeO}$
(c) $\text{Cu}_2\text{S} + \text{FeS}$ (d) $\text{FeO} + \text{CuO}$

80. Very pure dinitrogen can be obtained by the thermal decomposition of which substance?

- (a) Sodium azide (b) Ammonium dichromate
(c) Ammonium nitrite (d) Barium nitrite

Mathematics

81. $\int \frac{x^5+1}{x+1} dx = \text{_____} + C$

- (a) $\sum_{n=1}^4 \left((-1)^{n+1} \cdot \frac{x^n}{n} \right)$ (b) $\sum_{n=1}^5 \left((-1)^{n+1} \cdot \frac{x^n}{n} \right)$
(c) $\sum_{n=1}^4 \left((-1)^n \cdot \frac{x^n}{n} \right)$ (d) $\sum_{n=1}^5 \left((-1)^n \cdot \frac{x^n}{n} \right)$

82. $\int_{-1}^1 \cot^{-1} x dx = \text{_____}$

- (a) 0 (b) $\frac{\pi}{2}$
(c) π (d) 2π

83. $\int \tan\left(\frac{\pi}{4} - x\right) \cdot (2 + 2\sin 2x) dx$ ____ + C

- (a) $\sin 2x$ (b) $-\sin 2x$
(c) $2\sin 2x$ (d) $-2\sin 2x$

84. $\int_0^1 \frac{dx}{(3x+2)+\sqrt{3x+2}} =$ _____

- (a) $-\frac{2}{3} \log \left| \frac{\sqrt{5}+1}{\sqrt{2}+1} \right|$ (b) $\frac{2}{3} \log \left| \frac{\sqrt{5}+1}{\sqrt{2}+1} \right|$
(c) $2 \log |\sqrt{5} + 1|$ (d) $\frac{2}{3} \log |\sqrt{5} + 1|$

85. If $\int \frac{\cos 3x}{\sin x} dx = p \cos 2x + q \log |\sin x| + C$, then $p + q =$ ____

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

86. $\int e^x (2021 + \tan x + \tan^2 x) dx =$ ____ + C.

- (a) $(2021 + \tan x)e^x$ (b) $(2020 + \tan x)e^x$
(c) $(2020 + \tan x)$ (d) $(2000 + \tan x)e^x$

87. If area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is $\frac{\pi}{6}$, then equation of ellipse is ____

- (a) $\frac{x^2}{4} + \frac{y^2}{9} = 1$ (b) $4x^2 + 9y^2 = 1$
(c) $\frac{x^2}{36} + y^2 = 1$ (d) $x^2 + y^2 = 36$

88. Area of the region bounded by the curve $y^2 = 4x$, Y-axis and the line $y = 3$ is ____

- (a) 2 (b) $\frac{9}{3}$
(c) $\frac{9}{4}$ (d) $\frac{9}{2}$

89. Area of the region bounded by the curve $y^2 = x$ and the lines $x = 1$, $x = 4$ and X-axis in the first quadrant is ____

- (a) $\frac{14}{3}$ (b) $\frac{7}{3}$
(c) $\frac{28}{3}$ (d) 14

90. The general solution of the differential equation $\frac{dy}{dx} = e^{x-y}$ is ____

- (a) $e^x + e^y = C$ (b) $e^{-x} + e^y = C$
(c) $e^{-x} + e^{-y} = C$ (d) $e^x - e^y = C$

91. The number of arbitrary constants in the particular solution of a differential equation of order 4 are:

- (a) 4 (b) 2
(c) 3 (d) 0

92. Order and degree of the differential equation $e^{\frac{d^2y}{dx^2}} = x$ are ____ respectively

- (a) 2 and not defined (b) 1 and 2
(c) 2 and 1 (d) 1 and not defined

93. If $\vec{c}$ is the unit vector in the direction of sum of the vectors $\vec{a} = 2\hat{i} + 2\hat{j} - 5\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + 3\hat{k}$, then $|\vec{c}| =$ ____

- (a) $\frac{4}{\sqrt{29}}\hat{i} + \frac{3}{\sqrt{29}}\hat{j} - \frac{2}{\sqrt{29}}\hat{k}$ (b) 1
(c) 0 (d) -1

94. Let the vector $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$ and $|\vec{b}| = \frac{\sqrt{2}}{3}$, then $\vec{a} \times \vec{b}$ is unit vector, if the angle between $\vec{a}$ and $\vec{b}$ is ____

- (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$
(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

95. The area of parallelogram whose adjacent sides are determined by the vectors $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$ is ____

- (a) $15\sqrt{2}$ (b) 15
(c) $\frac{15}{\sqrt{2}}$ (d) $\frac{15}{2}$

96. The distance of a point $(2, 5, -3)$ from the plane $6x - 3y + 2z - 4 = 0$ is ____

- (a) $\frac{13}{\sqrt{7}}$ (b) $\frac{5}{7}$
(c) $\frac{5}{\sqrt{7}}$ (d) $\frac{13}{7}$

97. The coordinates of the foot of the perpendicular drawn from the origin to the plane $2x - 3y + 4z - 12 = 0$ is ____

- (a) $\left(\frac{12}{29}, -\frac{18}{29}, \frac{24}{29}\right)$ (b) $\left(\frac{24}{29}, -\frac{36}{29}, \frac{48}{29}\right)$
(c) $\left(\frac{24}{\sqrt{29}}, -\frac{36}{\sqrt{29}}, \frac{48}{\sqrt{29}}\right)$ (d) $\left(\frac{12}{\sqrt{29}}, -\frac{18}{\sqrt{29}}, \frac{24}{\sqrt{29}}\right)$

98. If $2x + 3y - z + 7 = 0$ and $x - 2y + kz + 2 = 0$ are two perpendicular planes, then $k =$ ____

- (a) 4 (b) 8
(c) -4 (d) -8

99. Minimize: $Z = 2x + 3y$, subject to constraints $2x + 4y \leq 12$, $x + y \leq 3$, $x \geq 0$ and $y \geq 0$.

- (a) 9 (d) 12
(c) 6 (d) 0

100. If $P(A) = \frac{6}{11}$, $P(B) = \frac{5}{11}$ and $P(A \cup B) = \frac{7}{11}$, then $P(A/B) =$

- (a) $\frac{4}{5}$ (b) $\frac{2}{3}$
(c) $\frac{4}{11}$ (d) $\frac{2}{11}$

101. For two mutually exclusive events A and B if $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{5}$ and $P(B') = p$, then $p =$ ____

- (a) $\frac{1}{5}$ (b) $\frac{9}{10}$
(c) $\frac{2}{5}$ (d) $\frac{1}{10}$

102. If A and B are two events such that $P(A) \neq 0$ and $P(B/A) = 1$, then ____

- (a) $B \subset A$ (b) $B = \emptyset$
(c) $A = \emptyset$ (d) $A \subset B$

103. Let R be the relation in the set $\{x: x \in \mathbb{N}, x \leq 4\}$ given by $R = \{(1, 1), (2, 2), (3, 3)\}$ then, R is

- (a) reflexive and symmetric but not transitive
(b) symmetric and transitive but not reflexive
(c) reflexive and transitive but not symmetric
(d) an equivalence relation

104. Function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined as $f(x) = x^3$, f is .

- (a) one-one and onto
(b) one-one but not onto
(c) many-one and onto
(d) neither one-one nor onto

105. If $f(x) = \frac{1+x}{1-x}$; $x \neq 1$, then $f(x) \cdot f(y) =$ ____

- (a) $f\left(\frac{x+y}{1-xy}\right)$ (b) $f(x \cdot y)$
(c) $f\left(\frac{x+y}{1+xy}\right)$ (d) $f\left(\frac{1}{1+xy}\right)$

106. $\cos^2(\sin^{-1} x) + \sin^2(\cos^{-1} x) = \underline{\hspace{1cm}} ; 0 < x < 1$

- (a) $2\sqrt{1-x^2}$ (b) $2(x^2-1)$
(c) 0 (d) $2(1-x^2)$

107. Solution set of $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$ is $\underline{\hspace{1cm}}$

- (a) $\{\frac{1}{6}, -1\}$ (b) $\{0, 1\}$
(c) $\{\frac{1}{6}, 1\}$ (d) $\{\frac{1}{6}\}$

108. If $AB = \begin{bmatrix} -6 & 26 \\ -1 & 19 \end{bmatrix}$ and $11B^{-1} = \begin{bmatrix} 5 & -3 \\ 2 & 1 \end{bmatrix}$, then $A = \underline{\hspace{1cm}}$

- (a) $\begin{bmatrix} -2 & 4 \\ 3 & -2 \end{bmatrix}$ (b) $\begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$
(c) $\begin{bmatrix} 2 & -4 \\ -3 & 2 \end{bmatrix}$ (d) $\begin{bmatrix} -2 & 4 \\ 3 & 2 \end{bmatrix}$

109. If $A = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then $(A+B)^{-1} = \underline{\hspace{1cm}}$

- (a) $\frac{1}{25}I_3$ (b) $-\frac{1}{5}I_3$
(c) $\frac{1}{5}I_3$ (d) $-\frac{1}{25}I_3$

110. If $A = \begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$, then which one of the following is incorrect.

- (a) $(AB)' = A'B'$ (b) $A \cdot \text{adj } A = |A|I$
(c) $(A+B)' = B' + A'$ (d) $(AB)^{-1} = B^{-1} \cdot A^{-1}$

111. $A(1, 3), B(0, 0)$ and $C(k, 0)$ are vertices of $\triangle ABC$. If area of $\triangle ABC$ is 3 units, then k is $\underline{\hspace{1cm}}$

- (a) 2 (b) 0
(c) -2 (d) ± 2

112. If $2 \begin{vmatrix} \sin(A+B) & \cos(A+B) \\ \cos(A-B) & \sin(A-B) \end{vmatrix} + \sqrt{3} = 0$, then $A = \underline{\hspace{1cm}}$

- (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$
(c) $\frac{\pi}{12}$ (d) $\frac{\pi}{4}$

113. For $\begin{vmatrix} 2 & 3 & 5 \\ 1 & 0 & 7 \\ -1 & -2 & 4 \end{vmatrix}$, the sum of minor and cofactor of 7 = $\underline{\hspace{1cm}}$

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

114. $\frac{d}{dx}(\text{cosec}^{-1} e^x) = \underline{\hspace{1cm}}$

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

115. If $f(x) = 4x^3 + 3x^2 + 3x + 4; x \neq 0$, then $\frac{d}{dx}\left(x^3 \cdot f\left(\frac{1}{x}\right)\right) = \underline{\hspace{1cm}}$

- (a) $24x^5 + 15x^4 + 12x^3 + 12x^2$
(b) $\frac{12}{x^2} + \frac{6}{x} + 3$
(c) $\frac{x^2}{12} + \frac{x}{6} + \frac{1}{3}$
(d) $12x^2 + 6x + 3$

116. $\frac{d}{dx}\left[\log\left(\frac{1}{x}\right) + \log\left(\frac{1}{x^2}\right) + \log\left(\frac{1}{x^3}\right)\right] = \underline{\hspace{1cm}} ; x > 1$

- (a) $-\frac{6}{x}$ (b) $6x$
(c) $\frac{6}{x}$ (d) $-6x$

117. If $x + 1 = e^{-y}$, then $\frac{d^2y}{dx^2} =$ _____

- (a) $\left(\frac{dy}{dx}\right)^3$ (b) $\frac{dy}{dx}$
(c) $\left(\frac{dy}{dx}\right)^2$ (d) $-\frac{dy}{dx}$

118. The slope of normal to the curve $y = 2x^2 + 3\sin x$ at $x = 0$ is _____

- (a) 3 (b) -3
(c) $\frac{1}{3}$ (d) $-\frac{1}{3}$

119. The point on the curve $x^2 = 2y$ which is nearest to the point (0, 5) is _____

- (a) $(2\sqrt{2}, 4)$ (b) (0, 0)
(c) $(2\sqrt{2}, 0)$ (d) (2, 2)

120. The interval in which $y = x^2 \cdot e^{-x}$ is increasing is _____

- (a) $(-\infty, \infty)$ (b) $(2, \infty)$
(c) $(-2, 0)$ (d) (0, 2)

Biology

121. In human, chromosome 1 has most genes _____ and the Y has the fewest genes _____ respectively.

- (a) 2698,231 (b) 2968,213
(c) 2968,231 (d) 2698, 213

122. In which body part of female Anopheles mosquito, gametes of parasite plasmodium fertilize and develop?

- (a) Salivary gland (b) Rectum
(c) RBC (d) Gut

123. In cases of snakebites, the injection which is given to patients, contain preformed antibodies against the snake venom. This type of immunisation is called _____

- (a) Active immunity (b) Both kinds of immunity
(c) Passive immunity (d) Partial passive immunity

124. 'Contact inhibition' is the property of which cells?

- (a) neoplastic cells
(b) normal cells
(c) the cells that possess oncogenes
(d) benign tumor cells

125. Choose the correct option for the given columns:

Column I (Source)	Column II (Substance)	Column III (Function)
(P) Trichoderma polysporum	(a) Statins	(i) Clot buster

(Q) <i>Monascus purpureus</i>	(b) Streptokinase	(ii) Organ-transplant
(R) <i>Streptococcus</i>	(c) Cyclosporin	(iii) Control blood cholesterol

P Q R

- (a) (a – iii)(c – i) (b – ii)
 (b) (b – ii)(a – i)(c – iii)
 (c) (c – iii)(b – i) (a – ii)
 (d) (c – ii) (a – iii) (b – i)

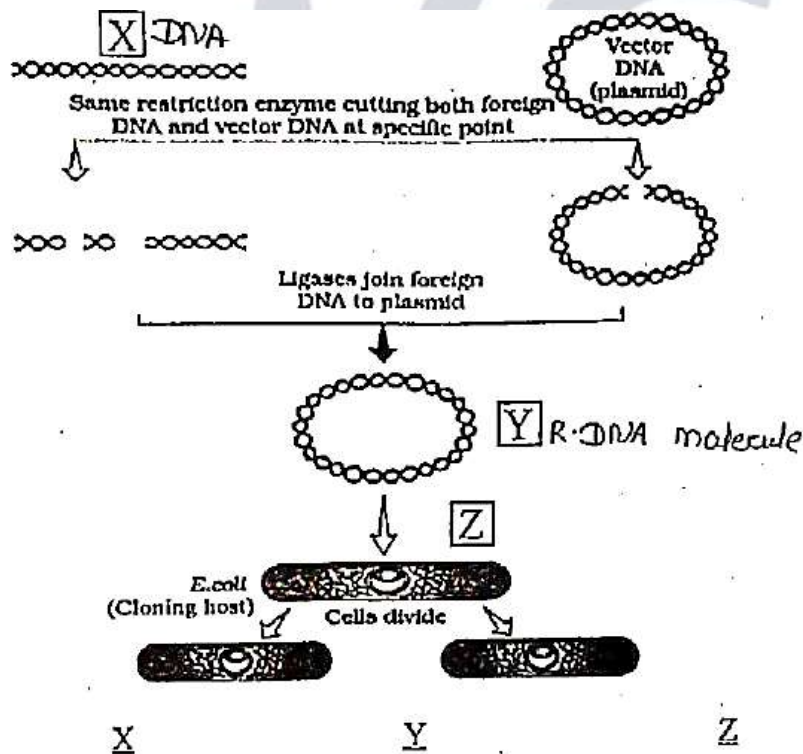
126. Choose the correct option, which shows correct sequence of substances obtained during sequential process of sewage treatment.

- (a) Primary sludge → flocs → effluent → anaerobic sludge
 (b) Primary sludge → anaerobic sludge → flocs → effluent
 (c) Primary sludge → effluent → flocs → anaerobic sludge
 (d) Primary sludge → anaerobic sludge → effluent → flocs

127. As biological - controller, Baculo viruses are pathogens to which organisms?

- (a) fungi and insects
 (b) insects and beetles
 (c) insects and other arthropods
 (d) beetles and arthropods

128. For given diagram choose the correct option for 'X', 'Y' and 'Z'.



- (a) DNA Recombinant DNA molecule transformation

- (b) foreign DNA Recombinant DNA molecule transformation
- (c) foreignDNA Recombinant DNA molecule transduction
- (d) DNA Recombinant DNA molecule transduction

129. A p-DNA is inserted within the coding sequence of an enzyme, β -galactosidase? This results into inactivation of the gene for synthesis of this enzyme, which is referred to as ____

- (a) recombinant inactivation
- (b) insertional activation
- (c) insertional inactivation
- (d) combinational inactivation

130. Choose the correct option that represents correct sequential steps for PCR method.

- (a) Denaturation $\rightarrow$ Annealing $\rightarrow$ Extension $\rightarrow$ Amplification
- (b) Denaturation $\rightarrow$ Extension $\rightarrow$ Annealing $\rightarrow$ Amplification
- (c) Denaturation $\rightarrow$ Annealing $\rightarrow$ Amplification $\rightarrow$ Extension
- (d) Denaturation $\rightarrow$ Extension $\rightarrow$ Amplification $\rightarrow$ Annealing

131. Statement - I - : ELISA is based on the principle of antigen - antibody interaction:

Statement- II Infection by pathogen can be detected by the presence of antigens or by detecting the antibodies synthesised against the pathogens.

- (a) Statements I and II both are correct
- (b) Statement I is incorrect, but statement II is correct
- (c) Statement I is correct, but statement II is incorrect
- (d) Statements I and II both are incorrect

132. Human protein $\alpha - 1$ - antitrypsin is used to treat which disease?

- (a) leukemia (b) emphysema
- (c) cancer (d) AIDS

133. RNA interference takes place in all eukaryotic organisms as a method of cellular defense. This method involves silencing of a specific mRNA due to a ____ molecule.

- (a) complementary ss DNA.
- (b) complementary ss RNA
- (c) complementary ds DNA
- (d) complementary ds RNA

134. Choose the correct statement for 'Allen's Rule'.

- (a) Mammals from colder climates generally have longer ears and shorter limbs to minimise heat loss
- (b) Mammals from colder climates generally have longer ears and longer limbs to minimise heat loss
- (c) Mammals from colder climates generally have shorter ears and shorter limbs to minimise heat loss
- (d) Mammals from colder climates generally have shorter ears and longer limbs to minimise heat loss

135. Logistic Growth is expressed by which of the following equation?

- (a) $\frac{dN}{dt} = rN \left(\frac{K-N}{K} \right)$
- (b) $\frac{dN}{dt} = rN$
- (c) $N_t = N_0 e^{rt}$
- (d) $\frac{dN}{dt} = N \left(\frac{K-N}{K} \right)$

136. Which species of plant employs 'sexual deceit' to get pollination done by a species of bee?

- (a) Yucca (b) Kigelia
- (c) Commelina (d) Mediterranean orchid

137. 'Species - Area relationships' was given by which scientist?

- (a) Allen (b) Alexander von Humboldt
(c) Paul Elorlick (d) Gause

138. Amazon rain forest is being cut and cleared for cultivating which plant?

- (a) barley (b) maize
(c) sugarcane (d) soya beans

139. Statement I: In many cultures, tracts of forest were set aside, and all the trees and wild life within were venerated and given total protection are referred as sacred groves.

Statement II : In Meghalaya, the sacred groves are the last refuges for a large number of rare and threatened animals.

- (a) Statements I and II both are correct
(b) Statement I is incorrect, but statement II is correct
(c) Statement I is correct, but statement II is incorrect
(d) Statements I and II both are incorrect

140. Select the correct option showing correct sequence for the structures developed by Penicillium, Hydra and sponges for Asexual mode of reproduction.

- (a) Zoospores, buds, gemmules
(b) Fragmentation, gemmules, buds.
(c) Conidia, buds, gemmules
(d). Fragmentation, buds, gemmules

141. Select the correct option for seasonal breeders.

- (a) monkeys, dogs (b) dogs, sheep
(c) human, tiger (d) human, apes

142. Match the following columns for organisms and meiocytes and choose the correct option.

Column - I (Name of the Organism)		Column-II (Meiocytes)
(P)	Housefly	(i) 12
(Q)	Fruit fly	(ii) 42
(R)	Butterfly	(iii) 08
(S)	Rat	(iv) 360

- (a) (i) (iv) (iii) (ii) (b) (i) (iii) (iv) (ii)
(c) (ii) (iii) (iv) (ii) (d) (ii) (iv) (iii) (i)

143. Study the following statements:

(i) Pollen grains of many species cause severe allergies and bronchial afflictions in some people often leading to chronic respiratory disorders.

(II) Pollen grains are rich in nutrients.

(III) Carrot grass that came into India as a contaminant with imported rice. Choose the option for the correct statements:

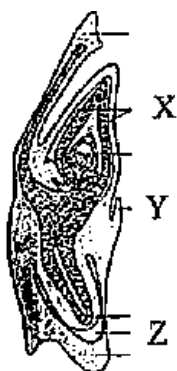
- (a) Statements I and III are correct, but statement II is incorrect.

- (b) All statements are incorrect
(c) Statements I and II are correct but statement III is incorrect
(d) All given statements are correct

144. What will be the respective ploidy of the cells of the nucellus, MMC (Megaspore Mother Cell), the functional megaspore and female gametophyte?

- (a) $2n, n, n, n$ (b) $2n, n, n, 2n$
(c) $2n, 2n, n, n$ (d) $n, 2n, n, 2n$

145. For given diagram, choose the correct labelling for 'X', 'Y' and 'Z'.



X Y Z

- (a) scutellum coleoptile radicle
(b) coleoptile shoot apex coleorhiza
(c) shoot apex epiblast Root cap
(d) coleoptile epiblast Root cap
146. The entry of oxygen and water into the seed during germination is facilitated by____
(a) Integuments (b) Seed coat
(c) Micropyle (d) Hilum
147. The major features of embryonic development at various months of pregnancy are given below. Choose the correct option for correct sequential events.
(I) The first movements of the foetus
(II) The foetus develops limbs and digits
(III) The embryo's heart is formed
(IV) The body is covered with fine hair
(a) (II), (IV), (I), (III) (b) (IV), (II), (I), (III)
(c) (II), (III), (IV), (I) (d) (III), (II), (I), (IV)
148. Placenta also acts as an endocrine tissue and produces several hormones choose the correct option for it.
(a) hPL, hCG, progesterone, oxytocin
(b) hPL, hCG, estrogen, relaxin
(c) hPL, hCG, estrogen, progesterone
(d) hPL, hCG, progesterone, relaxin
149. In male, for normal fertility, X sperms must have normal shape and size and Y sperms must show vigorous motility.

- | | |
|-------------------|--------------|
| X | y |
| (a) at least 60%, | at least 40% |
| (b) maximum 60%, | minimum 40% |
| (c) at least 40%, | at least 60% |
| (d) minimum 60%, | maximum 40% |

150. Which the part of oviduct, joins the uterus?

- (a) Fimbriae (b) Isthmus
(c) Ampulla (d) Infundibulum

151. Choose the correct option for full term of PID.

- (a) Pregnancy Inflammatory Disease
(b) Pelvic Inflammatory Disease
(c) Pregnancy Infection Disease
(d) Pelvic Infection Disease

152. Choose correct option for non - medicated IUDs.

- (a) Lippes loop (b) Multiload 375
(c) LNG-20 (d) Cu T

153. Select the incorrect option for ART.

- (a) IUT - The embryos up to 8 blastomeres could be transferred into the fallopian tube.
(b) ICSI - A sperm is directly injected into the ovum.
(c) GIFT - Transfer of an ovum collected from a donor into the fallopian tube of another female.
(d) ZIFT - The early embryo could be transferred into the fallopian tube.

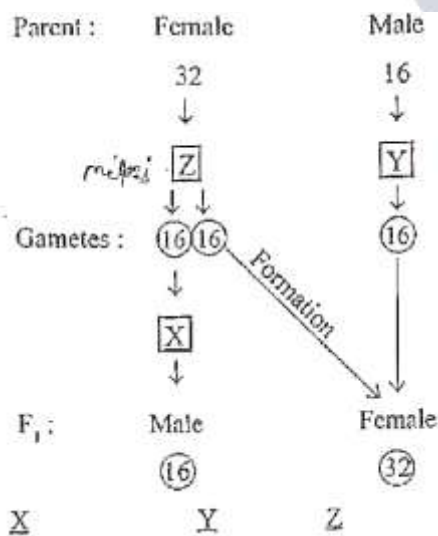
154. Which characteristic feature of Dog flower plant shows incomplete dominance?

- (a) Colour of the flower (b) Seed colour
(c) Height of the plant (d) Seed shape

155. The phenotype of one parent for skin colour is AABBCc and other parent is aabbcc. What will be the skin colour and genotype for their progeny?

- (a) darkest skin colour, AaBbCc
(b) lightest skin colour, AaBbCc
(c) intermediate skin colour, AaBbCc
(d) intermediate skin colour, AaBBcc

156. For given chart, choose correct option for 'X', 'Y' and 'Z'.



- (a) Parthenogenesis Mitosis Meiosis

- (b) Mitosis Meiosis Parthenogenesis
- (c) Parthenogenesis Meiosis Mitosis
- (d) Meiosis Mitosis Parthenogenesis

157. Linked genes HBA1 and HBA2 are located on which pair of chromosomes?

- (a) 11 (b) 14
- (c) 22 (d) 16

158. Study the following statements:

(I) Bacteriophage lambda has 5386 base pairs (bp)

(II) E. coli has 4.6×10^6 bp

(III) haploid content of human DNA is 3.3×10^9 bp

Find the option for incorrect statement.

- (a) Only statement I (b) Only statement III
- (c) Only statement II (d) Statements I and II

159. A segment of DNA coding for a polypeptide, the structural gene in a transcription unit is called ____

- (a) Cistron (b) Octamer
- (c) Nucleosome (d) Chromatin

160. In Hershey and chase experiment radioactive S^{35} detected in

- (a) Supernatant (b) Pellet
- (c) Both (d) None

