

Physics

- An air-cored solenoid with length 30 cm, area of cross-section 25 cm^2 and number of turns 500, carries a current of 2.5 A. The current is suddenly switched off in a brief time of 10^{-3} s . How much is the average back emf induced across the ends of the open switch in the circuit? Ignore the variation in magnetic field near the ends of the solenoid.
(a) 6.54 V (b) 65.4 V
(c) 654 V (d) 0.654 V
- For an ideal transformer, if $N_s > N_p$ then ____
(a) $V_s < V_p$ (b) $V_s > V_p$
(c) $V_s = V_p$ (d) None of these
- A charged $10 \mu\text{F}$ capacitor is connected to a 16 mH inductor. What is the angular frequency of free oscillations of the circuit?
(a) 250 rads^{-1} (b) 25 rads^{-1}
(c) 1111 rads^{-1} (d) 2500 rads^{-1}
- A light bulb is rated at 200 W for a 220 V supply. Find the resistance of the bulb
(a) 220Ω (b) 484Ω
(c) 242Ω (d) 400Ω
- A radio can tune into any station in the 6 MHz to 12 MHz band. What is the corresponding wavelength band? ($c = 3 \times 10^8 \text{ m/s}$)
(a) 40 m to 60 m (b) 25 m to 50 m
(c) 20 m to 30 m (d) 10 m to 20 m
- A charged particle oscillates about its mean equilibrium position with a frequency of 10^9 Hz . What is the frequency of the electromagnetic waves produced by the oscillator?
(a) 10^{18} Hz (b) 10^9 Hz
(c) 10^{-9} Hz (d) 10^{10} Hz
- Light from a point source in air falls on a spherical glass surface ($n = 1.5$ and radius of curvature = 20 cm). The distance of the light source from the glass surface is 100 cm. Find the image distance.
(a) -100 cm (b) -200 cm.
(c) 200 cm (d) 100 cm
- Double - convex lenses are to be manufactured from a glass of refractive index 1.55 with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 20 cm?
(a) 44 cm (b) 2.2 cm
(c) 22 cm (d) 4.4 cm
- What is the focal length of a convex lens of focal length 30 cm in contact with a concave lens of focal length 10 cm? [Ignore thickness of lens]
(a) -15 cm (b) -40 cm
(c) -20 cm (d) -30 cm
- Unpolarised light is incident on a plane glass surface. What should be the angle of incidence so that the reflected and refracted rays are perpendicular to each other? Given- $n = 1.5$
(a) 56° (b) 57°
(c) 58° (d) 59°
- Two slits are made 3 millimetre (3 mm) apart and the screen is placed 2 m away. What is the fringe separation when blue-green light of wavelength 600 nm is used?
(a) 0.4 mm (b) 0.6 mm
(c) 0.5 mm (d) 0.7 mm
- Estimate the distance for which ray optics is good approximation for an aperture of 5 mm and wavelength 500 nm .

- (a) 50 m (b) 18 m
(c) 40 m (d) 60 m

13. What is the de-Broglie wavelength associated with an electron moving with a speed of 6.4×10^6 m/s ?
[Mass of electron $m_e = 9.11 \times 10^{-31}$ kg, Planck's constant $h = 6.63 \times 10^{-34}$ J.s.]

- (a) 0.124 nm (b) 0.114 nm
(c) 0.135 nm (d) 0.145 nm

14. An electron, an α -particle and a proton have the same kinetic energy. Which of these particles has the shortest de-Broglie wavelength?

- (a) α -particle (b) Electron
(c) Proton (d) None of these

15. A difference of 5.4 eV separates two energy levels in an atom. What is the frequency of radiation emitted when the atom make a transition from the upper level to the lower level?

[1eV = 1.6×10^{-19} J, $h = 6.625 \times 10^{-34}$ J.s.]

- (a) 1.304×10^{15} Hz (b) 5.6×10^{15} Hz
(c) 5.6×10^{14} Hz (d) 1.304×10^{14} Hz

16. What is the shortest wavelength present in the Paschen series of spectral lines?

- (a) 320 nm (b) 720 nm
(c) 840 nm (d) 820 nm

17. The radius of the innermost electron orbit of a hydrogen atom is 5.3×10^{-11} m. What are the radii of the $n = 3$ orbit?

- (a) 4.12×10^{-10} m (b) 4.77×10^{-10} m
(c) 2.12×10^{-10} m (d) 2.24×10^{-10} m

18. In accordance with the Bohr's model, find the quantum number that characterises the earth's revolution around the sun in an orbit of radius 1.5×10^{11} m with orbital speed 3×10^4 m/s. (Mass of earth = 6×10^{24} kg, $h = 6.625 \times 10^{-34}$ J.s.)

- (a) 3.6×10^{74} (b) 1.6×10^{74}
(c) 2.6×10^{74} (d) 4.6×10^{74}

19. Given the following atomic masses

$${}_{92}^{238}\text{U} = 238.05079\text{u}$$

$${}_{2}^4\text{He} = 4.00260\text{u}$$

$${}_{90}^{234}\text{Th} = 234.04363\text{u}$$

Calculate the energy released during the alpha decay of ${}_{92}^{238}\text{U}$.

(1u = 931.5MeV/ c^2)

- (a) 4.25 MeV (b) 6.23 MeV
(c) 5.75 MeV (d) 3.25 MeV

20. A radioactive isotope has a half-life of T years. How long will it take the activity to reduce to 6.250% ?

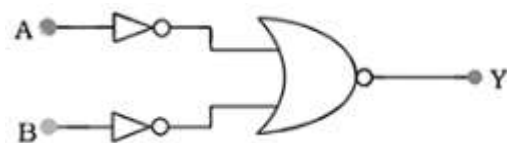
- (a) 3 T (b) 6 T
(c) 5 T (d) 4 T

21. The half-life of ${}_{38}^{90}\text{Sr}$ is 28 years. What is the disintegration rate of 38 g of this isotope?

[$N_A = 6.023 \times 10^{23}$ mol $^{-1}$]

- (a) 2.7×10^{14} Bq (b) 4.7×10^{14} Bq
(c) 3.7×10^{14} Bq (d) 5.7×10^{14} Bq

22. The circuits shown in fig. works as which gate?



- (a) NAND gate (b) OR gate
(c) AND gate (d) NOR gate

23. When a forward bias is applied to a p-n junction, it _____

- (a) raises the potential barrier
(b) reduces the majority carrier current to zero
(c) lowers the potential barrier
(d) none of the above

24. Suppose a pure Si crystal has 5×10^{28} atoms m^{-3} . It is doped by 1 ppm concentration of pentavalent As. Calculate the number of electrons and holes.

Given that $n_1 = 1.5 \times 10^{16} \text{ m}^{-3}$

- (a) $6.5 \times 10^9 \text{ m}^{-3}$ (b) $4.5 \times 10^9 \text{ m}^{-3}$
(c) $5.5 \times 10^9 \text{ m}^{-3}$ (d) $5.5 \times 10^{-9} \text{ m}^{-3}$

25. Dimensional formula of Electric flux = _____

- (a) $\text{M}^1 \text{L}^{-3} \text{T}^{-3} \text{A}^{-1}$ (b) $\text{M}^1 \text{L}^3 \text{T}^3 \text{A}^{-1}$
(c) $\text{M}^1 \text{L}^3 \text{T}^{-3} \text{A}^{-1}$ (d) $\text{M}^{-1} \text{L}^3 \text{T}^{-3} \text{A}^{-1}$

26. An electric dipole with dipole moment $4 \times 10^{-9} \text{ cm}$ is aligned at 60° with the direction of a uniform electric field of magnitude $5 \times 10^4 \text{ NC}^{-1}$. Calculate the magnitude of the torque acting on the dipole.

- (a) $17.3 \times 10^{-5} \text{ Nm}$ (b) $1.73 \times 10^{-4} \text{ Nm}$
(c) $1.73 \times 10^{-5} \text{ Nm}$ (d) $17.3 \times 10^{-4} \text{ Nm}$

27. An infinite line charge produces a field of $9 \times 10^4 \text{ NC}^{-1}$ at a distance of 2 cm. Calculate Electrical field produced at a distance of 3 cm .

- (a) $6 \times 10^4 \text{ NC}^{-1}$ (b) $6 \times 10^3 \text{ NC}^{-1}$
(c) $6 \times 10^{-5} \text{ NC}^{-1}$ (d) $6 \times 10^2 \text{ NC}^{-1}$

28. How will you connect 4 (four) capacitors, each of capacitance $4 \mu\text{F}$ for having equivalent capacitance $1.6 \mu\text{F}$?

- (a) Two in parallel and two in series
(b) All four in series
(c) All four in parallel
(d) Three in parallel and one in series

29. A slab of material of dielectric constant 3 has the same area as the plates of a parallel plate capacitor but has a thickness $\left(\frac{3}{4}\right)d$, where d is the separation of the plates. What is the Electrical potential difference between the plates, when the slab is inserted between the plates? Initial electrical potential difference V_0 .

- (a) $\frac{V_0}{6}$ (b) $\frac{V_0}{4}$
(c) $\frac{V_0}{2}$ (d) $\frac{V_0}{3}$

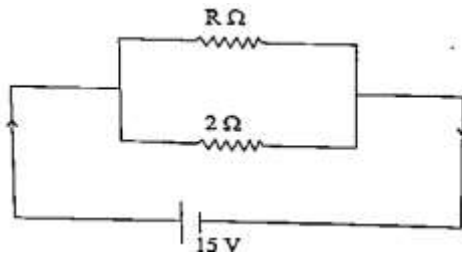
30. A molecule of a substance has a permanent electric dipole moment of magnitude 10^{-29} cm . 2 mole of this substance is polarised (at low temperature) by applying a strong electrostatic field of magnitude 10^6 Vm^{-1} . What should be potential energy of its? [1 mole of the substance contains 6×10^{23} molecules]

- (a) -6 J (b) -12 J
(c) 12 J (d) 6 J

31. At room temperature (27°C) the resistance of a heating element is 100Ω . What is the temperature of the element if the resistance is found to be 137Ω , given that the temperature coefficient of the material of the resistor is $1.35 \times 10^{-4} \text{ }^\circ\text{C}^{-1}$.

- (a) 2767°C (b) 1227°C
(c) 1027°C (d) 2327°C

32.



For the given following circuit diagram, the dissipated of electrical power 150 W , then find value of Resistance $R = \underline{\hspace{2cm}}$

- (a) 5Ω (b) 8Ω
(c) 6Ω (d) 3Ω

33. The number density of free electrons in a copper conductor estimated $8.5 \times 10^{28} \text{ m}^{-3}$. How long does an electron take to drift from one end of a wire 6 m long to its other end? The area of cross-section of the wire is $1.0 \times 10^{-6} \text{ m}^2$ and it is carrying a current of 1.5 A .

- (a) $8.1 \times 10^4 \text{ s}$ (b) $5.4 \times 10^4 \text{ s}$
(c) $12.7 \times 10^4 \text{ s}$ (d) $4.5 \times 10^4 \text{ s}$

34. A solenoid of length 0.25 m has a radius of 1 cm and is made up of 500 turns. It carries a current of 2.5 A . What is the magnitude of the magnetic field inside the solenoid? ($\mu_0 = 4\pi \times 10^{-7} \text{ SI}$)

- (a) $6.28 \times 10^{-3} \text{ T}$ (b) $6.28 \times 10^{-2} \text{ T}$
(c) $6.28 \times 10^{-4} \text{ T}$ (d) $6.28 \times 10^{-1} \text{ T}$

35. How the shunt wire should be?

- (a) short and thin (b) long and thin
(c) long and thick (d) short and thick

36. Two long and parallel straight wires A and B carrying currents of 10 A and 4 A in the same direction are separated by a distance of 2 cm . Estimate the force on a 4 cm section of wire A. ($\mu_0 = 4\pi \times 10^{-7} \text{ SI}$)

- (a) $1.6 \times 10^{-4} \text{ N}$ (b) $1.6 \times 10^{-5} \text{ N}$
(c) $1.6 \times 10^{-6} \text{ N}$ (d) $1.6 \times 10^{-3} \text{ N}$

37. A solenoid has a core of a material with relative permeability 400 . The windings of the solenoid are insulated from the core and carry a current of 1 A . If the number of turns is 1000 per metre, find magnetic field (B) $\underline{\hspace{2cm}} \text{ T}$. ($\mu_0 = 4\pi \times 10^{-7} \text{ SI}$)

- (a) $1.6\pi \times 10^{+2}$ (b) $16\pi \times 10^2$
(c) $16\pi \times 10^{-2}$ (d) $0.16\pi \times 10^{-2}$

38. A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.25 T experiences a torque of magnitude equal to $4.5 \times 10^{-2} \text{ J}$. What is the magnitude of magnetic moment of the magnet?

- (a) 0.36 J T^{-1} (b) 0.036 J T^{-1}
(c) 3.6 J T^{-1} (d) 36 J T^{-1}

39. "The polarity of induced emf is such that it tends to produce a current which opposes the change in magnetic flux that produced it." This statement is known as ____

- (a) Faraday (b) Maxwell
(c) Kirchhoff (d) Lenz

40. 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 s, what is the change of flux linkage with the other coil?

- (a) 30 Wb (b) 1.5 Wb
(c) 15 Wb (d) 0.15 Wb

Chemistry

41. Hybridisation in XeF_2 and XeF_4 are respectively ____

- (a) sp^2 and $sp^3 d^2$ (b) $sp^3 d$ and $sp^3 d^2$
(c) sp and sp^3 (d) $sp^3 d$ and sp^3

42. Which is the correct options for bonds and their number in pyrophosphoric acid?

- (a) Two P-OH, Four P = O, One P-O-P
(b) Four P-OH, One P = O, One P-O-P
(c) Two P-OH, Four P = O, Two P-O-P
(d) Four P-OH, Two P = O, One P-O-P

43. Name a transition element which does not exhibit variable oxidation states.

- (a) Zinc (b) Copper
(c) Scandium (d) Chromium

44. Which statement is incorrect from the following?

- (a) CrO is basic, but Cr_2O_3 is amphoteric
(b) 'Cd' is not consider as transition element
(c) Atomic sizes of elements of '4d' series is greater than corresponding elements of '3d' series
(d) Atomic sizes of elements of '5d' series is greater than corresponding '4d' series

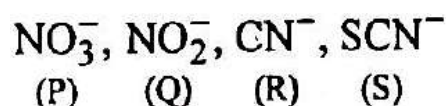
45. How many numbers of Geometrical Isomers of $[\text{Pt}(\text{NH}_3)(\text{Br})(\text{Cl})(\text{Py})]$ will have?

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

46. How many numbers of mole Ions produced from aqueous solution of 1 mole Iron (III) hexacyanido Ferrate (II) complex?

- (a) 4 (b) 7
(c) 5 (d) 6

47. Which of the following ligand is ambidentate?



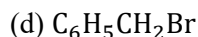
- (a) R and S (b) P and Q
(c) Q and S (d) Q and R

48. How many numbers of sigma (σ) and pi (π) bonds in DDT respectively?

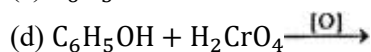
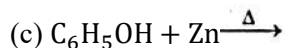
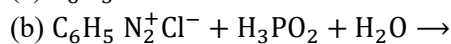
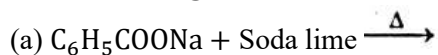
- (a) 28 and 6 (b) 29 and 6
(c) 30 and 6 (d) 21 and 6

49. Which of the following undergoes $\text{S}_\text{N}2$ reaction most readily?

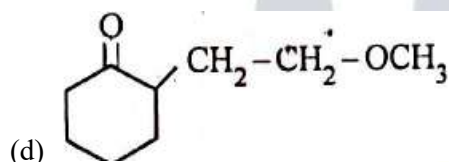
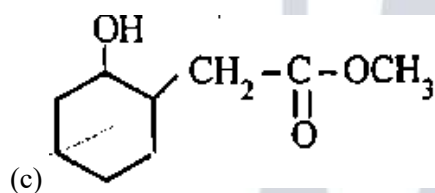
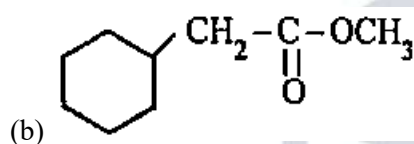
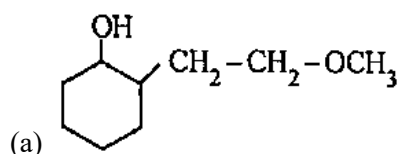
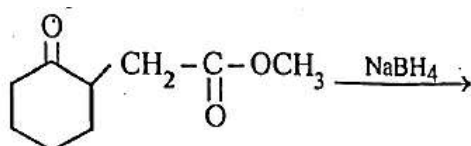
- (a) $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$
(b) $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$



50. From following reactions, which reaction does not give "Benzene"?



51. Which product is obtained from following reaction?



52. Which method is used to prepare salicylic acid from phenol?

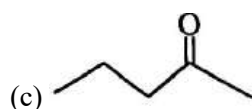
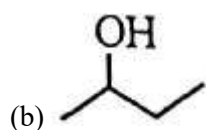
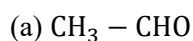
(a) Stephen reaction

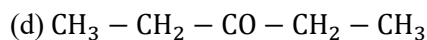
(b) Kolbe's reaction

(c) Etard reaction

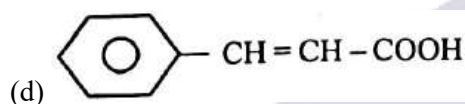
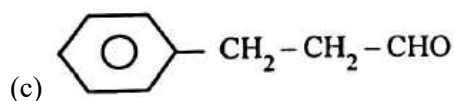
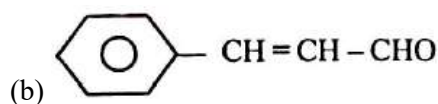
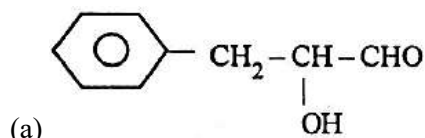
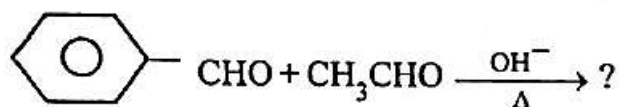
(d) Reimer-Tiemann reaction

53. Which of the following compounds will not give "Iodoform" by reaction with "sodium hypoiodide"?





54. What will be the main product in the following reaction?



55. Which is the incorrect order of increasing acidic strength for the following?

- (a) $\text{CH}_2\text{FCH}_2\text{CH}_2\text{COOH} < \text{CH}_3\text{CHFCH}_2\text{COOH}$
- (b) $\text{CH}_2\text{ClCOOH} < \text{CH}_2\text{FCOOH}$
- (c) $\text{CH}_3\text{COOH} < \text{CH}_2\text{ClCOOH}$
- (d) $\text{HCOOH} < \text{C}_6\text{H}_5\text{COOH}$

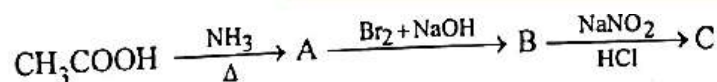
56. How many numbers of Isomer for the compound having molecular formula $\text{C}_3\text{H}_9\text{N}$?

- (a) 2
- (b) 3
- (c) 4
- (d) 5

57. From which of the following reaction primary amine is produced?

- (a) Reduction of Nitrile Compounds
- (b) Reduction of Amide Compounds
- (c) Hoffmann bromamide degradation reaction
- (d) Above all reactions

58. Identify the compound 'C' from following reaction.



- (a) $\text{CH}_3 - \text{CH}_2\text{N}_2^+\text{Cl}^-$
- (b) $\text{CH}_3 - \text{CH}_2\text{OH}$
- (c) CH_3OH
- (d) $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$

59. Select proper statement from following True (T) and False (F) statements.

- (I) Pentose sugar + base $\rightarrow$ Nucleotide
- (II) Nucleotide + Phosphate $\rightarrow$ Nucleoside
- (III) DNA contains four bases A, G C and T
- (IV) RNA contains four bases A, G C and U

- (a) FTFT
- (b) FTTT
- (c) FFTT
- (d) TTTT

60. Which glycosidic linkage occurs in 'Amylopectin'?

- (a) $C_1 - C_3$ and $C_1 - C_4$
- (b) $C_1 - C_4$ and $C_1 - C_6$
- (c) $C_1 - C_2$ and $C_1 - C_6$
- (d) $C_2 - C_4$ and $C_4 - C_6$

61. Which polymer is used in manufacture of paints and lacquers?

- (a) Glyptal (b) Teflon
- (c) Neoprene (d) Melamine

62. Which of the following polymer is not obtained by the condensation polymerization?

- (a) Decron (b) Nylon - 2 - Nylon - 6
- (c) Nylon - 6,6 (d) Polyacrylonitrile

63. Which of the following drug is used for treatment of Acidity?

- (a) Ranitidine (b) Meprobamate
- (c) Salvarsan (d) Codein

64. Which Artificial sweetener is unstable at cooking temperature?

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

65. Cell edge length in bcc, ccp and simple cubic unit cell is respectively as ____

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

66. Atoms of element N form hcp lattice and those of the element M occupy $1/3^{\text{rd}}$ c tetrahedral voids. What will be the formula of the compound formed by the element M and N?

- (a) $M_4 N_3$ (b) $M_1 N_2$
- (c) $M_2 N_3$ (d) M, N

67. Calculate the mole fraction of aqueous solution of 1 molal urea (NH_2CONH_2)

- (a) 0.01878 (b) 0.01768
- (c) 0.01800 (d) 0.01698

68. Value of Henry's constant K_H ____

- (a) no effect by changing temperature
- (b) decreases with increase in temperature
- (c) increases with increase in temperature
- (d) first decreases and then increases by increase in temperature

69. What is value of Van't Hoff factor (i) when 80% of CaCl_2 dissociates?

- (a) 2.70 (b) 3
- (c) 2.40 (d) 2.30

70. How much electricity in terms of Faraday is required for reduction of $2 \text{ mole } \text{Cr}_2\text{O}_7^{2-}$ into Cr^{3+} in acidic medium?

- (a) 12 F (b) 6 F
- (c) 3 F (d) 9 F

71. Which is proper value of x for the following to increase cell potential of $\text{Zn}_{(s)} | \text{Zn}_{(xM)}^{2+} || \text{Cu}_{(0.02M)}^{2+} | \text{Cu}_{(s)}$

- (a) $x = 0.02M$ (b) $x < 0.02M$
- (c) $x > 0.02M$ (d) $x \geq 0.02M$

72. Which substance is used as oxidizing agent in nickel-cadmium cell?

- (a) $\text{Ni}(\text{OH})_3$ (b) Cd
- (c) Ni (d) CdO

73. What is the value of slope when graph plotted of $\log \frac{[R]_0}{[R]}$ Vs t (time) for first order reaction?

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

74. A reaction is first order with respect to a reactant A and second order with respect to reactant B. What is the effect of rate when concentration of both A and B increased by doubled?

- (a) Eight times (b) Quadrupled
(c) Doubled (d) Sixteen times

75. Which colloidal sol results, when highly diluted solution of AgNO_3 is added to highly diluted KI solution?

- (a) $\cdot \text{AgI}/\text{NO}_3^-$ (b) AgI/K^+
(c) AgI/Ag^+ (d) AgI/I^-

76. Match the types of colloidal systems given in Column - I with the name given in Column - II.

	Column-I		Column - II
(i)	Solid in liquid	(p)	Aerosol
(ii)	Liquid in solid	(q)	Foam
(iii)	Liquid in gas	(r)	Sol
(iv)	Gas in liquid	(s)	Gel

- (a) (i) $\rightarrow$ (r), (ii) $\rightarrow$ (s), (iii) $\rightarrow$ (p), (iv) $\rightarrow$ (q)
(b) (i) $\rightarrow$ (s), (ii) $\rightarrow$ (r), (iii) $\rightarrow$ (p), (iv) $\rightarrow$ (q)
(c) (i) $\rightarrow$ (r), (ii) $\rightarrow$ (s), (iii) $\rightarrow$ (q), (iv) $\rightarrow$ (p)
(d) (i) $\rightarrow$ (p), (ii) $\rightarrow$ (q), (iii) $\rightarrow$ (r), (iv) $\rightarrow$ (s)

77. In which colloids both Lyophilic and Lyophobic parts present?

- (a) Micelle (b) Gold sol
(c) Rubber sol (d) Sol of As_2S_3

78. Which method is not proper to obtain metal of high purity from impure metal?

- (a) Leaching (b) Chromatographic methods
(c) Liquation (d) Distillation

79. Which is known as "Copper Matte"?

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

80. Which products are obtained by reaction of hot and concentrated NaOH with dichlorine?

- (a) $\text{NaCl} + \text{NaClO}_2 + \text{H}_2\text{O}$
(b) $\text{NaCl} + \text{NaClO}_4 + \text{H}_2\text{O}$
(c) $\text{NaCl} + \text{NaClO}_3 + \text{H}_2\text{O}$
(d) $\text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$

Mathematics

81. If $2\sin^{-1}x = \sin^{-1}2x\sqrt{1-x^2}$ then $x \in$ ____

- (a) $\left[-\frac{1}{\sqrt{2}}, 1\right]$ (b) $[0, 1]$
(c) $\left[\frac{1}{\sqrt{2}}, 1\right]$ (d) $\left[-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right]$

82. $\cos\left(\sin^{-1}\frac{1}{5} + \cos^{-1}x\right) = 0$ then $x =$

- (a) 1 (b) $\frac{1}{5}$
(c) 0 (d) 5

83. Binary operation $*$ on $\mathbb{R}$ is given by $a * b = \frac{a+b}{2}$. Then $*$ is

- (a) not commutative but associative
(b) commutative and associative
(c) commutative but not associative
(d) not commutative and not associative

84. Let $A = \{-1, -2, 3, 4\}$. Number of all one-one functions from the set A to itself is ____

- (a) 24 (b) 16
(c) 4 (d) 256

85. If functions f and g are defined as:

$$f: \left[0, \frac{\pi}{2}\right] \rightarrow \mathbb{R}, f(x) = \sin x \text{ and}$$

$$g: \left[0, \frac{\pi}{2}\right] \rightarrow \mathbb{R}, g(x) = \cos x$$

then ____

- (a) $f + g$ is one-one and fg is not one-one
(b) $f + g$ is not one-one and fg is one-one
(c) $f + g$ is not one-one and fg is not one-one
(d) $f + g$ is one-one and fg is one-one

86. If $y = 100e^{2x} + 200e^{-2x}$ and $\frac{d^2y}{dx^2} = ay$ then $a =$

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

87. Function $f: [1, 2, 1, 9] \rightarrow \mathbb{R}, f(x) = [x]$, where $[x]$ denotes the greatest integer less than or equal to x . Then

- (a) $f'(x) = 1$
(b) f is not differentiable
(c) $f'(x) = 0$
(d) f is not continuous function

88. If $x = \sqrt{10^{\sin^{-1}t}}, y = \sqrt{10^{\cos^{-1}t}}$ then $\frac{dy}{dx} =$ ____

- (a) $-\frac{x}{y}$ (b) $\frac{y}{x}$
(c) 0 (d) $-\frac{y}{x}$

89. The interval in which $y = x^2e^{-x}$ is increasing is ____

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

90. Equation of tangent line to $16x^2 + 25y^2 = 1$, which is parallel to Y -axis is ____

- (a) $5y - 1 = 0$ (b) $5x - 1 = 0$
(c) $4y + 1 = 0$ (d) $4x - 1 = 0$

91. A cylindrical tank of diameter 20 m is being filled with wheat at the rate of 314 cubic meter per hour. Then the depth of the wheat is increasing at the rate of ____

- (a) 0.5 m/h (b) 0.1 m/h
(c) 1.1 m/h (d) 1 m/h

92. $\int e^{\sin x} \sin 2x dx = \underline{\hspace{2cm}} + C.$

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

93. $\int \sqrt{\frac{\cos x - \cos^3 x}{1 - \cos^3 x}} dx = \underline{\hspace{2cm}} + C.$

- (a) $-\frac{3}{2} \cos^{-1}(\cos^{3/2} x)$
(b) $-\frac{2}{3} \cos^{-1}(\cos^{3/2} x)$
(c) $\frac{3}{2} \cos^{-1}(\cos^{3/2} x)$
(d) $\frac{2}{3} \cos^{-1}(\cos^{3/2} x)$

94. $\int (x+1)(x+3)(x+2)^7 dx = \underline{\hspace{2cm}} + C.$

- (a) $\frac{(x+3)^{10}}{10} + \frac{(x+3)^8}{8}$ (b) $\frac{(x+2)^{10}}{10} + \frac{(x+2)^8}{8}$
(c) $\frac{(x+3)^{10}}{10} - \frac{(x+3)^8}{8}$ (d) $\frac{(x+2)^{10}}{10} - \frac{(x+2)^8}{8}$

95. $\int \frac{x}{(x-1)(x-2)} dx = \underline{\hspace{2cm}} + C.$

- (a) $\log(x-1)(x-2)$ (b) $\log \left| \frac{(x-2)^2}{x-1} \right|$
(c) $\log \left| \left(\frac{x-1}{x-2} \right)^2 \right|$ (d) $\log \left| \frac{(x-1)^2}{x-2} \right|$

96. $\int_{-\pi/4}^{\pi/4} \sin^2 x dx = \underline{\hspace{2cm}}$

- (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{4} - \frac{1}{2}$
(c) $\frac{\pi}{4} - 1$ (d) $\frac{\pi}{4} + \frac{1}{2}$

97. $\int_{\frac{\pi}{2}}^{\pi} (x^{13} + x \cos x + \tan^{15} x + 1) dx = \underline{\hspace{2cm}}$

- (a) 1 (b) 2
(c) π (d) 0

98. If $f(a+b-x) = f(x)$ then $\int_a^b x f(x) dx = \underline{\hspace{2cm}}$

- (a) $\frac{a+b}{2} \int_a^b f(x) dx$ (b) $\frac{a+b}{2} \int_a^b f(b+x) dx$
(c) $\frac{b-a}{2} \int_a^b f(x) dx$ (d) $\frac{a+b}{2} \int_a^b f(b-x) dx$

99. $\int_0^1 \tan^{-1} \left(\frac{2x-1}{1+x-x^2} \right) dx = \underline{\hspace{2cm}}$

- (a) $\frac{\pi}{4}$ (b) 0
(c) -1 (d) 1

100. The area of the region bounded by the two parabolas $y = x^2$ and $y^2 = x$ is

- (a) $\frac{3}{4}$ (b) 3
(c) $\frac{1}{2}$ (d) $\frac{1}{3}$

101. The area of the parabola $x^2 = 12y$ bounded by its latus rectum is

- (a) 3 (b) $\frac{24}{3}$
(c) 24 (d) $\frac{8}{3}$

102. The area of the region bounded by the curve $y^2 = 4x$ and the line $x = 3$ is ____
 (a) $3\sqrt{3}$ (b) $3\sqrt{8}$
 (c) 8 (d) $8\sqrt{3}$
103. If length of subnormal at any point of a curve is always constant then that curve represents a ____
 (a) Parabola (b) Hyperbola
 (c) Ellipse (d) Rectangular hyperbola
104. The integrating factor of the differential equation $x \frac{dy}{dx} - y = x^2$ is ____
 (a) e^{-x} (b) $\frac{1}{x}$
 (c) e^x (d) x
105. If the vectors $\hat{i} - \hat{j} + \hat{k}$, $3\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} + \lambda\hat{j} - 3\hat{k}$ are coplanar then $\lambda =$ ____
 (a) 15 (b) -15
 (c) 5 (d) $\frac{5}{3}$
106. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$ and $|\vec{b}| = \frac{\sqrt{2}}{3}$. If $\vec{a} \times \vec{b}$ is a unit vector, then the angle between $\vec{a}$ and $\vec{b}$ is ____
 (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$
 (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{6}$
107. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ then $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a} =$ ____
 (a) $-\frac{1}{2}$ (b) $\frac{3}{2}$
 (c) $\frac{1}{2}$ (d) $-\frac{3}{2}$
108. The angle between the line $\frac{x+1}{2} = \frac{y}{3} = \frac{z-3}{6}$ and the plane $10x + 2y - 11z = 3$ is ____
 (a) $\cos^{-1}\left(\frac{1}{8}\right)$ (b) $\cos^{-1}\left(\frac{8}{21}\right)$
 (c) $\sin^{-1}\left(\frac{8}{21}\right)$ (d) $\sin^{-1}\left(\frac{1}{8}\right)$
109. The area of a triangle having the points $A(-1, 1, 1)$, $B(1, 2, 3)$ and $C(2, 3, 1)$ as its vertices is ____
 (a) $\frac{\sqrt{19}}{2}$ (b) $\frac{\sqrt{21}}{2}$
 (c) $\frac{19}{2}$ (d) $\frac{21}{2}$
110. The lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are at right angles then value of p is ____
 (a) $\frac{11}{7}$ (b) 7
 (c) $\frac{70}{11}$ (d) $\frac{7}{11}$
111. The mean number of heads in three tosses of a fair coin is ____
 (a) 3.5 (b) 0.5
 (c) 15 (d) 1.5
112. If for Bernoulli distribution $B\left(10, \frac{1}{2}\right)$, it is given that $P(X \leq 2) = m\left(\frac{1}{2}\right)^{10}$ then $m =$ ____
 (a) 101 (b) 55
 (c) 56 (d) 46
113. Probability that A speaks truth is $\frac{4}{5}$. A coin is tossed. A reports that a head appears. The probability that actually there was head is ____
 (a) $\frac{2}{5}$ (b) $\frac{4}{5}$
 (c) $\frac{1}{5}$ (d) $\frac{1}{2}$
114. Corner points of the feasible region of objective function $Z = 3x + 9y$ of a linear programming problem are $(0, 10)$, $(5, 5)$, $(15, 15)$ and $(0, 20)$. Minimum value of Z is ____

- (a) 70 (b) 90
(c) 50 (d) 60

115. If $A = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$ then $A^3 =$ _____

- (a) $\begin{bmatrix} \cos 3\theta & \sin 3\theta \\ -\cos 3\theta & \sin 3\theta \end{bmatrix}$
(b) $\begin{bmatrix} -\cos 3\theta & \sin 3\theta \\ \sin 3\theta & \cos 3\theta \end{bmatrix}$
(c) $\begin{bmatrix} \cos 3\theta & \sin 3\theta \\ -\sin 3\theta & \cos 3\theta \end{bmatrix}$
(d) $\begin{bmatrix} \cos 3\theta & -\sin 3\theta \\ -\sin 3\theta & \cos 3\theta \end{bmatrix}$

116. Let $A = \begin{bmatrix} 1 & -1 & -1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ and $10B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$, if B is the inverse of matrix A, then α is

- (a) -2 (b) 1
(c) 2 (d) 5

117. For real numbers x, y, z such that $x \neq y \neq z$, $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$ and $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} \neq 0$ then $xyz =$ _____

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

118. If a, b, c are measurements of sides of $\triangle ABC$ and $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0$ then $\sin^2 A + \sin^2 B + \sin^2 C =$ _____

- (a) $\frac{13}{4}$ (b) $\frac{9}{4}$
(c) $\frac{15}{4}$ (d) $\frac{11}{4}$

119. If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ then sum of all the elements of $A^{-1} =$ _____

- (a) 6 (b) -6
(c) 0 (d) $\frac{11}{6}$

120. If $\sin^{-1} a = \alpha + \beta$, $\sin^{-1} b = \alpha - \beta$ then $\sin^2 \alpha + \cos^2 \beta =$ _____

- (a) ab (b) $1 - ab$
(c) $ab - 1$ (d) $1 + ab$

Biology

121. Choose the correct option out of the following.

- (a) Butyric Acid-Clostridium butylicum
(b) Acetic acid - Aspergillus niger
(c) Streptokinase - immunosuppressive agent in organ transplant
(d) Cyclosporine A - used as a 'clot buster' for removing clots from blood vessels

122. What is the BOD value per litre in sewage water?

- (a) 400 – 500mg (b) 200 – 500mg
(c) 200 – 400mg (d) 500 – 600mg

123. Which statements are true out of the following?

- (P) Endonuclease make cuts at specific positions within the DNA
(Q) A stirred - tank reactor is usually square in shape
(R) Bacterial cells must be first be made competent to take up DNA. This is done by treating them with

divalent cation Mg^{++} .

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

124. Statement A - DNA cannot pass through cell membrane

Reason R - DNA is a hydrophobic molecule

- (a) Statement A is correct and Reason R is wrong
- (b) Statement A and Reason R both are correct because R is not the explanation of A
- (c) Statement A and Reason R both are correct because R is the explanation of A
- (d) Statement A is wrong and Reason R is correct

125. The Fragments of DNA can be separated by a technique known as

- (a) Gel electrophoresis
- (b) Micro injection
- (c) Gene gun
- (d) Biolistics

126. _____ infects the roots of tobacco plants and causes a great reduction in yield.

- (a) Wuchereria bancrofti
- (b) Bacillus thuringiensis
- (c) Meloidogyne incognita
- (d) Ascaris lumbricoides

127. In some children ADA deficiency can be cured by which transplantation?

- (a) Bone marrow
- (b) Liver
- (c) Kidney
- (d) Spleen

128. In Rosie cow, which is nutritionally more balanced product for babies?

- (a) Beta-lactalbumin
- (b) Alpha - lactalbumin
- (c) Albumin
- (d) Immunoglobulin

129. In which region maximum and minimum, mean annual precipitation is observed respectively?

- (a) Gross land, Desert
- (b) Tropical forest, Temperate forest
- (c) Tropical forest, Desert
- (d) Coniferous forest, Temperate forest

130. Which animal is capable of meeting all its water requirements through its internal fat oxidation?

- (a) Kangaroo rat
- (b) Snail
- (c) Kangaroo
- (d) Rat

131. If you were to count the number of insects feeding on a big tree, what kind of pyramid would you get?

- (a) Oblique
- (b) Inverted
- (c) Upright
- (d) Upright - inverted

132. Which stage of plant succession stage is shown in the given diagram?



- (a) Phytoplankton
- (b) Submerged plant stage
- (c) Reed - swamp stage
- (d) Submerged free floating plant stage

133. "That within a region species richness increased with increasing explored area, but only up to a limit." Which naturalist has proposed this statement?

- (a) Paul Ehrlich (b) David Tilman
(c) Alexander von Humboldt (d) Trashow

134. Which species extinction in the last 500 years was due to over exploitation by humans?

- (a) Quagga (b) Dodo
(c) Steller's sea cow (d) Thylacine

135. Which nutrient is absent in dirty water of sewage?

- (a) Nitrate (b) Ammonia
(c) Sodium (d) Copper

136. What is the unit of measurement of thickness of ozone layer?

- (a) DU (b) DB
(c) DO (d) DN

137. Absence of teeth, bifid tongue and mental retardness are observed in ____

- (a) Down's syndrome
(b) Albinism
(c) Klinefelter's syndrome
(d) Oral-facial-digital syndrome

138. Match the following. Choose the correct option.

	Column - I		Column - II
(i)	Conidia	(P)	Sponges
(ii)	buds	(Q)	Penicillium
(iii)	offset	(R)	Water hyacinth
(iv)	Gemmules	(S)	Hydra

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

139. Chromosome numbers in rice leaf is X and chromosome numbers in egg of rat is Y.

- (a) X = 34, Y = 21 (b) X = 12, Y = 24
(c) X = 24, Y = 21 (d) X = 20, Y = 24

140. Which type of carpel is observed in Michelia?

- (a) Bicarpellary, syncarpous
(b) Multi carpellary, apocarpous
(c) Multi carpellary, syncarpous
(d) Bicarpellary, apocarpous

141. In water hyacinth and water lily, the pollination is carried out by which agent?

- (a) Water (b) Only wind
(c) Only insects (d) Insects or wind

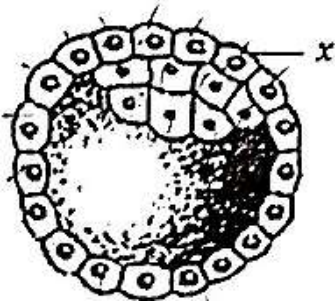
142. In black pepper remnants of nucellus persistent is known as ____

- (a) Embryo (b) Endosperm
(c) Perisperm (d) Plumule

143. _____ hormone acts on the sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis.

- (a) TSH (b) FSH
(c) LH (d) PIF

144. What indicates 'x' in the following diagram?



- (a) Trophoblast (b) Inner cell mass
(c) Blastomeres (d) Uterine cells

145. Zona Pellucida is first observed in _____

- (a) Tertiary follicle (b) Secondary follicle
(c) Primary follicle (d) Graafian follicle

146. The hormone releasing IUD is _____

- (a) Multiload 375 (b) Cu – 7
(c) LNG-20 (d) Cu – T

147. In which ART method more than 8 blastomeres are transferred into the uterus to complete its further development?

- (a) IUI (b) IUT
(c) GIFT (d) ZIFT

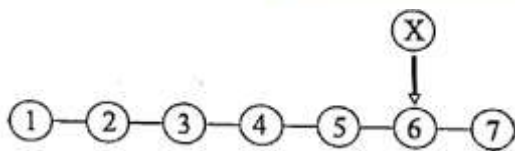
148. The blood group of Ramesh bhai is B and his daughter's blood group is AB. What will be the blood group of his wife?

- (a) B or O (b) A or AB
(c) A or B (d) A or O

149. "The behaviour of chromosomes was parallel to the behaviour of genes" was proposed by _____

- (a) Walter Sutton and Theodor Boveri
(b) Alfred Hershey and Martha Chase
(c) Watson and Crick
(d) MacLeod and McCarty

150. Choose the correct triplet codon option for 'X'.



[Sickle cell HbS peptide]

- (a) GAU (b) GAG
(c) GUG (d) GAA

151. Histone proteins are rich in _____ and _____ amino acids.

- (a) Lysine, Arginine
(b) Arginine, Tyrosine
(c) Lysine, Aspartic acid
(d) Glutamic acid, Lysine

152. What is the correct sequence to transfer genetic material from virus to bacteria in Hershey - Chase experiment?

- (a) Infection-Centrifugation-Blending
- (b) Centrifugation - Blending-Infection
- (c) Centrifugation - Infection-Blending
- (d) Infection - Blending - Centrifugation

153. In Meselson and Stahl's experiment if *E. coli* was allowed to grow for 80 minutes then what would be the proportions of light and intermediate density of DNA molecule respectively? (If *E. coli* divides in every 20 minutes)

- (a) 12: 2 (b) 6: 2
- (c) 2: 2 (d) 14: 2

154. The brain capacity of *Homo habilis* is _____

- (a) 1400cc – 1600cc (b) 1350cc – 1400cc
- (c) 650cc – 800cc (d) 900cc – 1200cc

155. In Gir forest out of 100 individuals 40 individuals are recessive. Calculate the percentage of heterozygous progeny by Hardy - Weinberg principle.

- (a) 48% (b) 16%
- (c) 36% (d) 24%

156. The _____ test confirmed the disease caused by salmonella typhi.

- (a) ELISA Test (b) Widal Test
- (c) W.B. Test (d) PCR Test

157. _____ quickly reduce the symptoms of allergy.

- (a) Serotonin (b) Heparin
- (c) Adrenaline (d) Histamine

158. When ready - made antibodies are directly given to protect the body against foreign agents, it is called _____

- (a) Humoral immune response
- (b) Cytoplasm mediated immunity
- (c) Cell mediated immunity
- (d) Passive immunity

159. Which of the following crop of Okra (Bhindi) is insect pest resistance?

- (a) Pusa Sawani (b) Pusa Sem
- (c) Pusa Gaurav (d) Pusa Komal

160. Which statement is incorrect for successful Bee-keeping?

- (a) Management of beehives during any one season
- (b) Knowledge of the nature and habits of bees
- (c) Selection of suitable location for keeping the beehives
- (d) Catching and hiving of swarms