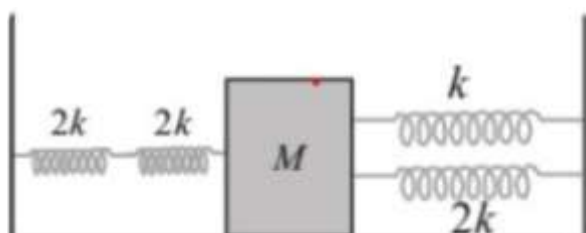


PART-I PHYSICS

- The electric potential V is given as a function of distance x (metre) by $V = (5x^2 + 10x - 4)$ volt. Value of electric field at $x = 1$ m is
 (a) -23 V/m (b) 11 V/m
 (c) 6 V/m (d) -20 V/m
- A proton moving with a velocity 3×10^5 m/s enters a magnetic field of 0.3 tesla at an angle of 30° with the field. The radius of curvature of its path will be (e/m for proton = 10^8 C/kg)
 (a) 2 cm (b) 0.5 cm
 (c) 0.02 cm (d) 1.25 cm
- If force (F), length (L) and time (T) are assumed to be fundamental units, then the dimensional formula of the mass will be
 (a) $[FL^{-1} T^2]$ (b) $[FL^{-1} T^{-2}]$
 (c) $[FL^{-1} T^{-1}]$ (d) $[FL^2 T^2]$
- A metal disc of radius 100 cm is rotated at a constant angular speed of 60 rad/s in a plane at right angles to an external field of magnetic induction 0.05 Wb/m². The emf induced between the centre and a point on the rim will be
 (a) 3 V (b) 1.5 V
 (c) 6 V (d) 9 V
- A balloon is rising vertically up with a velocity of 29 ms⁻¹. A stone is dropped from it and it reaches the ground in 10 seconds. The height of the balloon when the stone was dropped from it, was ($g = 9.8$ ms⁻²)
 (a) 100 m (b) 200 m
 (c) 400 m (d) 150 m
- An alternating voltage $V = V_0 \sin \omega t$ is applied across a circuit. As a result, a current $I = I_0 \sin \left(\omega t - \frac{\pi}{2} \right)$ flows in it. The power consumed per cycle is
 (a) zero (b) $0.5 V_0 I_0$
 (c) $0.707 V_0 I_0$ (d) $1.414 V_0 I_0$
- A gun fires two bullets at 60° and 30° with horizontal. The bullets strike at some horizontal distance. The ratio of maximum height for the two bullets is in the ratio of
 (a) $2:1$ (b) $3:1$
 (c) $4:1$ (d) $1:1$
- Green light of wavelength $5460 \text{ \AA}$ is incident on an air-glass interface. If the refractive index of glass is 1.5 , the wavelength of light in glass would be ($c = 3 \times 10^8$ ms⁻¹)
 (a) $3640 \text{ \AA}$ (b) $5460 \text{ \AA}$
 (c) $4861 \text{ \AA}$ (d) None of the above
- Four massless springs whose force constants are $2k, 2k, k$ and $2k$ respectively are attached to a mass M kept on a frictionless plane (as shown in figure). If the mass M is displaced in the horizontal direction, then the frequency of the system



- (a) $\frac{1}{2\pi} \sqrt{\frac{4k}{M}}$ (b) $\frac{1}{\pi} \sqrt{\frac{k}{M}}$
 (c) $\frac{1}{2\pi} \sqrt{\frac{k}{7M}}$ (d) $\frac{1}{2\pi} \sqrt{\frac{7k}{M}}$

10. Suppose the law of gravitational attraction suddenly changes and becomes an inverse cube law i.e. $F \propto \frac{1}{r^3}$, but still remaining a central force. Then

- (a) Kepler's law of area still holds
 (b) Kepler's law of period still holds
 (c) Kepler's law of area and period still holds
 (d) neither the law of area, nor the law of period still holds

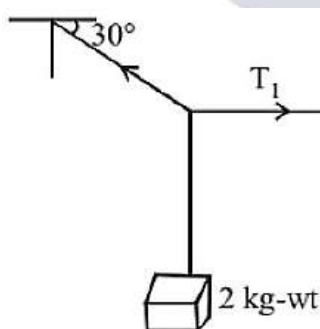
11. Three specimens A, B, C of same radioactive element has activities 1 microcurie, 1 rutherford and 1 becquerel respectively. Which specimen has maximum mass?

- (a) A (b) B
 (c) C (d) all have equal masses

12. A solenoid is 2 m long and 3 cm in diameter. It has 5 layers of winding of 1000 turns each and carries a current of 5 A. What is the magnetic field at its centre? Use the standard value of μ_0 .

- (a) 1.57×10^{-4} T (b) 2.57×10^{-3} T
 (c) 1.57×10^{-2} T (d) 3.57×10^{-6} T

13. A body of weight 2 kg is suspended as shown in the figure. The tension T_1 in the horizontal string (in kgwt) is



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

14. A wire of a certain material is stretched slowly by ten per cent. Its new resistance and specific resistance become respectively:

- (a) 1.2 times, 1.3 times
 (b) 1.21 times, same
 (c) both remain the same
 (d) 1.1 times, 1.1 times

15. The significant result deduced from the Rutherford's scattering experiment is that

- (a) whole of the positive charge is concentrated at the centre of atom
 (b) there are neutrons inside the nucleus
 (c) α - particles are helium nuclei
 (d) electrons are embedded in the atom

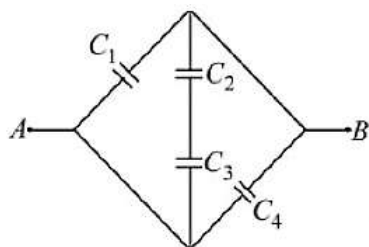
16. A ball of mass 0.2 kg is thrown vertically upwards by applying a force by hand. If the hand moves 0.2 m while applying the force and the ball goes upto 2 m height further, find the magnitude of the force. (Consider $g = 10 \text{ m/s}^2$).

- (a) 4 N (b) 16 N
(c) 20 N (d) 22 N

17. A zener diode of voltage $V_Z (= 6 \text{ V})$ is used to maintain a constant voltage across a load resistance $R_L (= 1000\Omega)$ by using a series resistance $R_s (= 100\Omega)$. If the e.m.f. of source is $E (= 9\text{V})$, what is the power being dissipated in Zener diode?

- (a) 0.144 watt (b) 0.324 watt
(c) 0.244 watt (d) 0.544 watt

18. In a given network the equivalent capacitance between A and B is $C_1 = C_4 = 1\mu\text{F}$, $C_2 = C_3 = 2\mu\text{F}$.



- (a) $3\mu\text{F}$ (b) $6\mu\text{F}$
(c) $4.5\mu\text{F}$ (d) $2.5\mu\text{F}$

19. In a simple pendulum of length l the bob is pulled aside from its equilibrium position through an angle θ and then released. The bob passes through the equilibrium position with speed

- (a) $\sqrt{2gl(1 + \cos \theta)}$ (b) $\sqrt{2gl \sin \theta}$
(c) $\sqrt{2gl}$ (d) $\sqrt{2gl(1 - \cos \theta)}$

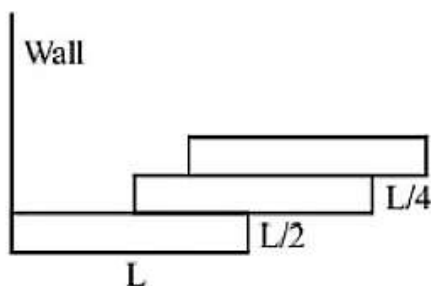
20. A moving coil galvanometer has resistance of 10Ω and full- scale deflection of 0.01 A . It can be converted into voltmeter of 10 V full scale by connecting into resistance of

- (a) 9.90Ω in series (b) 10Ω in series
(c) 990Ω in series (d) 0.10Ω

21. The frequency of whistle of an engine appears to be $(4/5)^{\text{th}}$ of initial frequency when it crosses a stationary observer. If the velocity of sound is 330 m/s , then the speed of engine will be

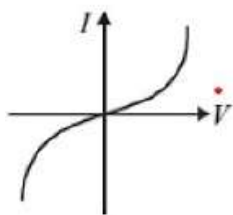
- (a) 30 m/s (b) 36.6 m/s
(c) 40 m/s (d) 330 m/s

22. Three bricks each of length L and mass M are arranged as shown from the wall. The distance of the centre of mass of the system from the wall is



- (a) $\frac{L}{4}$ (b) $\frac{L}{2}$
(c) $\left(\frac{3}{2}\right)L$ (d) $\left(\frac{11}{12}\right)L$

23. The $I - V$ characteristics shown in figure represents



- (a) ohmic conductors (b) non-ohmic conductors
(c) insulators (d) superconductors

24. The angle of dip at a place is 37° and the vertical component of the earth's magnetic field is $6 \times 10^{-5} \text{ T}$. The earth's magnetic field at this place is $\left(\tan 37^\circ = \frac{3}{4}\right)$

- (a) $7 \times 10^{-5} \text{ T}$ (b) $6 \times 10^{-5} \text{ T}$
(c) $5 \times 10^{-5} \text{ T}$ (d) 10^{-4} T

25. A round disc of moment of inertia I_2 about its axis perpendicular to its plane and passing through its centre is placed over another disc of moment of inertia I_1 rotating with an angular velocity ω about the same axis. The final angular velocity of the combination of discs is

- (a) $\frac{(I_1 + I_2)\omega}{I_1}$ (b) $\frac{I_2\omega}{I_1 + I_2}$
(c) ω (d) $\frac{I_1\omega}{I_1 + I_2}$

26. For an RLC circuit driven with voltage of amplitude V_m and frequency $\omega_0 = \frac{1}{\sqrt{LC}}$ the current exhibits resonance the quality factor, Q is given by

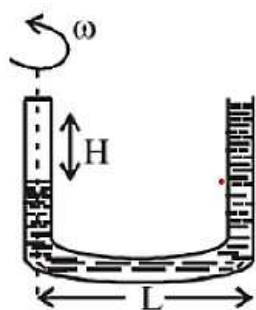
- (a) $\frac{\omega_0}{L}$ (b) $\frac{\omega_0 L}{R}$
(c) $\frac{R}{\omega_0 C}$ (d) $\frac{CR}{\omega_0}$

27. The two ends of a rod of length L and a uniform cross-sectional area A are kept at two temperatures T_1 and T_2 ($T_1 > T_2$). The rate of heat transfer, $\frac{dQ}{dt}$ through the rod in a steady state is given by:

- (a) $\frac{k(T_1 - T_2)}{LA}$ (b) $kLA(T_1 - T_2)$
(c) $\frac{kA(T_1 - T_2)}{L}$ (d) $\frac{kL(T_1 - T_2)}{A}$

28. A U-shaped tube contains a liquid of density ρ and it is rotated about the left dotted line as shown in the figure.

Find the difference in the levels of liquid column.



- (a) $\frac{\omega^2 L^2}{2g}$ (b) $\frac{\omega^2 L^2}{2\sqrt{2}g}$
(c) $\frac{2\omega^2 L^2}{g}$ (d) $\frac{2\sqrt{2}\omega^2 L^2}{g}$

29. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 9 mW. The number of photons arriving per sec on the average at a target irradiated by this beam is:

- (a) 3×10^{16} (b) 9×10^{15}
(c) 3×10^{19} (d) 9×10^{17}

30. The displacement y of a particle in a medium can be expressed as, $y = 10^{-6} \sin \left(100t + 20x + \frac{\pi}{4} \right)$ m where t is in second and x in meter. The speed of the wave is

- (a) 20 m/s (b) 5 m/s
(c) 2000 m/s (d) 5π m/s

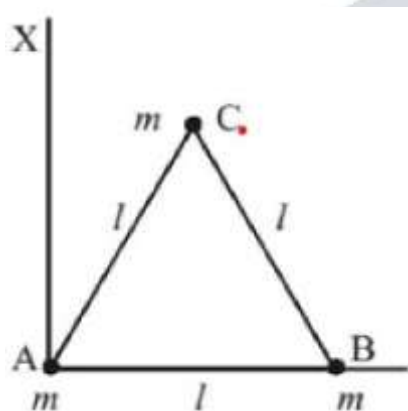
31. An ideal gas at atmospheric pressure is adiabatically compressed so that its density becomes 32 times of its initial value. If the final pressure of gas is 128 atmospheres, the value of ' γ ' of the gas is:

- (a) 1.5 (b) 1.4
(c) 1.3 (d) 1.6

32. A charge Q is placed at each of the opposite corners of a square. A charge q is placed at each of the other two corners. If the net electrical force on Q is zero, then $\frac{Q}{q}$ equals:

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

33. Three particles, each of mass m gram, are situated at the vertices of an equilateral triangle ABC of side 1 cm (as shown in the figure). The moment of inertia of the system about a line AX perpendicular to AB and in the plane of ABC, in gram - cm^2 units will be



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

34. Electrons are accelerated through a potential difference V and protons are accelerated through a potential difference $4V$. The de - Broglie wavelengths are λ_e and λ_p for electrons and protons respectively. The ratio of $\frac{\lambda_e}{\lambda_p}$ is given by: (given m_e is mass of electron and m_p is mass of proton).

- (a) $\sqrt{\frac{m_p}{m_e}}$ (b) $\sqrt{\frac{m_e}{m_p}}$
(c) $\frac{1}{2} \sqrt{\frac{m_e}{m_p}}$ (d) $2 \sqrt{\frac{m_p}{m_e}}$

35. The temperature of an ideal gas is increased from 120 K to 480 K. If at 120 K, the root mean square velocity of the gas molecules is v , at 480 K it becomes

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

36. A point particle is held on the axis of a ring of mass m and radius r at a distance r from its centre C. When released, it reaches C under the gravitational attraction of the ring. Its speed at C will be

- (a) $\sqrt{\frac{2Gm}{r}(\sqrt{2}-1)}$ (b) $\sqrt{\frac{Gm}{r}}$
 (c) $\sqrt{\frac{2Gm}{r}\left(1-\frac{1}{\sqrt{2}}\right)}$ (d) $\sqrt{\frac{2Gm}{r}}$

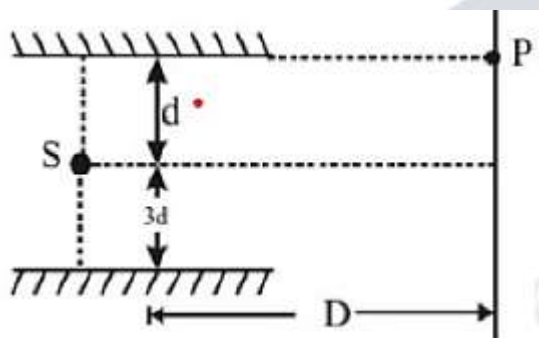
37. A plane electromagnetic wave is incident on a plane surface of area A , normally and is perfectly reflected. If energy E strikes the surface in time t then force exerted on the surface is (c = speed of light)

- (a) $\frac{2E}{Atc}$ (b) $\frac{E}{2c}$
 (c) $\frac{2E}{ct}$ (d) zero

38. The compressibility of water is 4×10^{-5} per unit atmospheric pressure. The decrease in volume of 100 cm^3 of water under a pressure of 100 atmosphere will be

- (a) 0.4 cm^3 (b) $4 \times 10^{-5} \text{ cm}^3$
 (c) 0.025 cm^3 (d) 0.004 cm^3

39. Consider the optical system shown in Fig. The point source of light S is having wavelength equal to λ . The light is reaching screen



only after reflection. For point P to be second maxima, the value of λ would be ($D \gg d$ and $d \gg \lambda$)

- (a) $\frac{12d^2}{D}$ (b) $\frac{6d^2}{D}$
 (c) $\frac{3d^2}{D}$ (d) $\frac{24d^2}{D}$

40. A spherical drop of radius R is divided into eight equal droplets. If surface tension is T , then the work done in this process is

- (a) $2\pi R^2 T$ (b) $3\pi R^2 T$
 (c) $4\pi R^2 T$ (d) $2\pi R T^2$

PART-II CHEMISTRY

41. Which one of the following ions has the maximum magnetic moment?

- (a) Sc^{3+} (b) Ti^{3+}
 (c) Cr^{3+} (d) Fe^{3+}

42. Which of the following represents the correct order of $\text{Cl}-\text{O}$ bond lengths in

ClO^- , ClO_2^- , ClO_3^- , ClO_4^- ?

- (a) $\text{ClO}_4^- = \text{ClO}_3^- = \text{ClO}_2^- = \text{ClO}^-$
 (b) $\text{ClO}^- < \text{ClO}_2^- < \text{ClO}_3^- < \text{ClO}_4^-$
 (c) $\text{ClO}_4^- < \text{ClO}_3^- < \text{ClO}_2^- < \text{ClO}^-$
 (d) $\text{ClO}_3^- < \text{ClO}_4^- < \text{ClO}_2^- < \text{ClO}^-$

43. Which one of the following coordination compounds is used to inhibit the growth of tumours?

- (a) Trans-platin (b) EDTA complex of calcium
 (c) $[(\text{Ph}_3\text{P})_3\text{RhCl}]$ (d) Cis - platin

44. Aspirin is known as:

- (a) acetyl salicylic acid (b) phenyl salicylate
 (c) acetyl salicylate (d) methyl salicylic acid

45. In a 1st order reaction, reactant concentration C varies with time t as:

- (a) $\frac{1}{C}$ increases linearly with t
 (b) $\log C$ decreases linearly with t
 (c) C decreases with $\frac{1}{t}$
 (d) $\log C$ decreases with $\frac{1}{t}$

46. Which of the following has the highest pπ - pπ bonding tendency?

- (a) N (b) P
 (c) As (d) Sb

47. Identify the incorrect statement:

- (a) The S - S - S bond angles in the S_8 and S_6 rings are the same.
 (b) Rhombic and monoclinic sulphur have S_8 molecules.
 (c) S_2 is paramagnetic like oxygen
 (d) S_8 ring has a crown shape.

48. Which of the following does not contain any coordinate bond?

- (a) H_3O^+ (b) BF_4^-
 (c) HF_2^- (d) SO_2^-

49. Which of the following set contains species having same angle around the central atom?

- (a) $\text{SF}_4, \text{CH}_4, \text{NH}_3$ (b) $\text{NF}_3, \text{BCl}_3, \text{NH}_3$
 (c) $\text{BF}_3, \text{NF}_3, \text{AlCl}_3$ (d) $\text{BF}_3, \text{BCl}_3, \text{BBR}_3$

50. Liquids A and B form an ideal solution in the entire composition range. At 350K, the vapor pressures of pure A and pure B are 7×10^3 Pa and 12×10^3 Pa, respectively. The composition of the vapour is in equilibrium with a solution containing 40 mole percent of A at this temperature is:

- (a) $x_A = 0.37$; $x_B = 0.63$
- (b) $x_A = 0.28$; $x_B = 0.72$
- (c) $x_A = 0.4$; $x_B = 0.6$
- (d) $x_A = 0.76$; $x_B = 0.24$

51. Hydrolysis of NCl_3 gives NH_3 and X. Which of the following is X ?

- (a) HClO_4 (b) HClO_3
- (c) HOCl (d) HClO_2

52. Element 'B' forms ccp structure and 'A' occupies half of the octahedral voids, while oxygen atoms occupy all the tetrahedral voids. The structure of bimetallic oxide is:

- (a) A_2BO_4 (b) AB_2O_4
- (c) $\text{A}_2\text{B}_2\text{O}$ (d) $\text{A}_4\text{B}_2\text{O}$

53. $[\text{Fe}(\text{en})_2(\text{H}_2\text{O})_2]^{2+} + \text{en} \rightarrow \text{complex (X)}$. The correct statement about the complex (X) is -

- (a) it is a low spin complex
- (b) it is diamagnetic
- (c) it shows geometrical isomerism
- (d) (a) and (b) both

54. The frequency of radiation emitted when the electron falls from $n = 4$ to $n = 1$ in a hydrogen atom will be (Given : ionization energy of H = 2.18×10^{-18} J atom⁻¹ and $h = 6.625 \times 10^{-34}$ Js)

- (a) $1.54 \times 10^{15} \text{ s}^{-1}$ (b) $1.03 \times 10^{15} \text{ s}^{-1}$
- (c) $3.08 \times 10^{15} \text{ s}^{-1}$ (d) $2.00 \times 10^{15} \text{ s}^{-1}$

55. Cetyltrimethyl ammonium bromide is a popular

- (a) anionic detergent (b) cationic detergent
- (c) non-ionic detergent (d) sweetener

56. Which of the following chemicals can be added for sweetening of food items at cooking temperature and does not provides calories?

- (a) Sucrose (b) Glucose
- (c) Aspartame (d) Sucralose

57. In XeF_2 , XeF_4 , XeF_6 the number of lone pairs on Xe are respectively

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

58. Which one of the following molecules will form a linear polymeric structure due to hydrogen bonding?

- (a) NH_3 (b) H_2O
 (c) HCl (d) HF

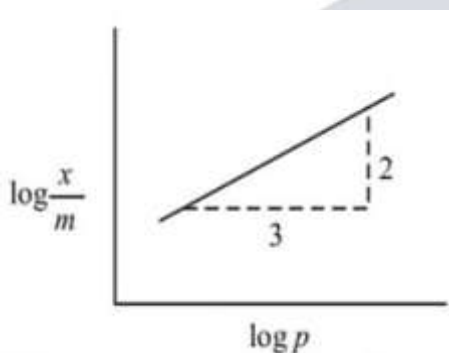
59. Arsenic containing medicine used for the treatment of syphilis, is

- (a) erythromycin (b) ofloxacin
 (c) tetracycline (d) salvarsan

60. The difference in the number of unpaired electrons of a metal ion in its high-spin and low-spin octahedral complexes is two. The metal ion is:

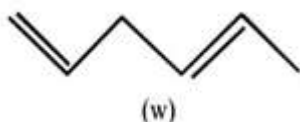
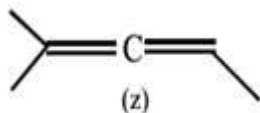
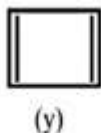
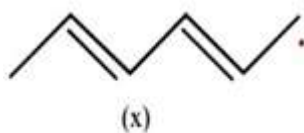
- (a) Ni^{2+} (b) Fe^{2+}
 (c) Co^{2+} (d) Mn^{2+}

61. Adsorption of a gas follows Freundlich adsorption isotherm. x is the mass of the gas adsorbed on mass m of the adsorbent. The plot of $\frac{x}{m}$ versus $\log p$ is shown in the given graph. $\frac{x}{m}$ is proportional to :



- (a) $p^{2/3}$ (b) $p^{3/2}$
 (c) p^3 (d) p^2

62. The correct stability order of following species is -



- (a) $x > y > w > z$ (b) $y > x > w > z$
 (c) $x > w > z > y$ (d) $z > x > y > W$

63. Nitrogen is obtained by the thermal decomposition of:

- (a) NH_4NO_2 (b) NH_4NO_3
 (c) AgNO_3 (d) $\text{Pb}(\text{NO}_3)_2$

64. Calculate the wavelength (in nanometer) associated with a proton moving at $1.0 \times 10^3 \text{ ms}^{-1}$.

(Mass of proton = $1.67 \times 10^{-27} \text{ kg}$ and $h = 6.63 \times 10^{-34} \text{ Js}$)

- (a) 0.40 nm (b) 2.5 nm
 (c) 14.0 nm (d) 0.32 nm

65. The solubility of silver bromide in hypo solution involves the formation of:

- (a) Ag_2SO_3 (b) $\text{Ag}_2 \text{S}_2\text{O}_3$
 (c) Ag^+ (d) NH_4^+

66. Fructose reduces Tollen's reagent due to:

- (a) enolisation of fructose followed by conversion to glucose (having aldehydic group) by the base present in Tollen's reagent
 (b) asymmetric carbons
 (c) primary alcoholic group
 (d) secondary alcoholic group

67. When C_2H_2 , CH_4 and C_2H_4 pass through a test tube which has ammonical Cu_2Cl_2 , find out which gas comes out unaffected from test tube?

- (a) C_2H_2 and CH_4 (b) C_2H_2 and C_2H_4
 (c) C_2H_4 and CH_4 (d) C_2H_2

68. Which of the following acts as an antioxidant in edible oils

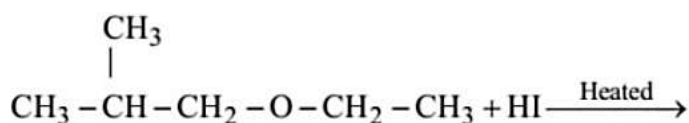
- (a) Vitamin B (b) Vitamin C
 (c) Vitamin D (d) Vitamin E

69.

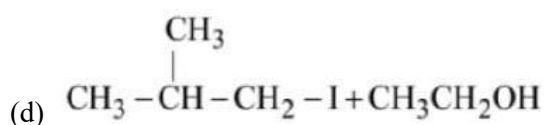
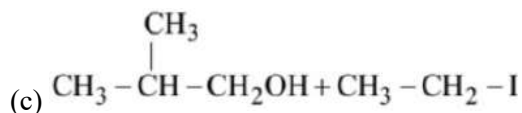
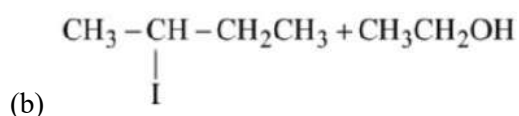
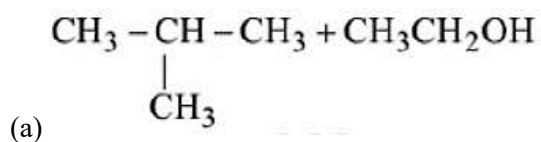
$[\text{A}] \xrightarrow{\text{reduction}} [\text{B}] \text{CHCl}_3 + \text{KOH} [\text{C}] \xrightarrow{\text{reduction}} \text{N - Methylaniline, A is}$

- (a) Formaldehyde (b) Trichloromethane
 (c) Nitrobenzene (d) Toluene

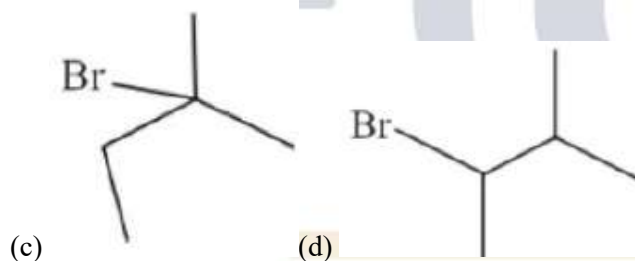
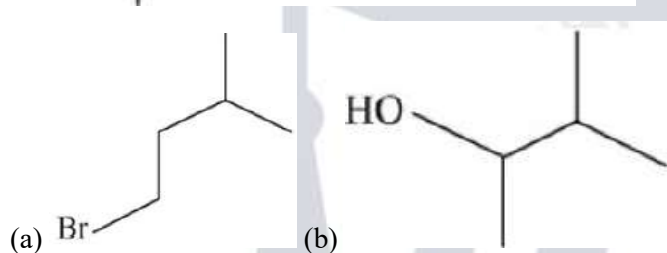
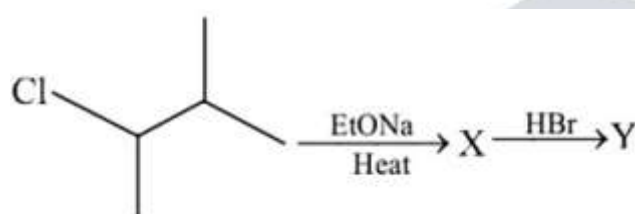
70. In the reaction:



Which of the following compounds will be formed?



71. The major product 'Y' in the following reaction is :



72. Biochemical oxygen demand (BOD) value can be a measure of water pollution caused by the organic matter.

Which of the following statements is correct?

- (a) Polluted water has BOD value higher than 10ppm
- (b) Aerobic bacteria decreases the BOD value
- (c) Anaerobic bacteria increases the BOD value
- (d) Clean water has BOD value higher than 10ppm

73. Which of the following has minimum melting point?

- (a) CsF
- (b) HCl
- (c) HF
- (d) LiF

74. X mL of H_2 gas effuses through a hole in a container in 5 seconds. The time taken for the effusion of the same volume of the gas specified below under identical conditions is :
- (a) 10 seconds : He (b) 20 seconds: O_2
 (c) 25 seconds: CO (d) 55 seconds : CO_2
75. Work out the heat change (cal) when 40 g of He gas at $27^\circ C$ undergoes isothermal and reversible compression from initial pressure of 1 atm to 10 atm ($R = 2 \text{ cal K}^{-1} \text{ mol}^{-1}$).
- (a) 13.818 kcal (b) -13.818 kcal
 (c) 55.272 kcal (d) -55.272 kcal
76. PCl_5 is dissociating 50% at $250^\circ C$ at a total pressure of P atm. If equilibrium constant is K_p , then which of the following relation is numerically correct -
- (a) $K_p = 3P$ (b) $P = 3K_p$
 (c) $P = \frac{2K_p}{3}$ (d) $K_p = \frac{2P}{3}$
77. For the reaction: $NH_3 + OCl^- \rightarrow N_2H_4 + Cl^-$ in basic medium, the coefficients of NH_3 , OCl^- and N_2H_4 for the balanced equation are respectively
- (a) 2,2,2 (b) 2,2,1
 (c) 2,1,1 (d) 4,4,2
78. Two elements A and B have similar chemical properties. They don't form solid hydrogen carbonates, but react with nitrogen to form nitrides. A and B, respectively, are:
- (a) Na and Rb (b) Na and Ca
 (c) Cs and Ba (d) Li and Mg
79. Diborane (B_2H_6) reacts independently with O_2 and H_2O to produce, respectively;
- (a) B_2O_3 and H_3BO_3 (b) B_2O_3 and $[BH_4]^-$
 (c) H_3BO_3 and B_2O_3 (d) HBO_2 and H_3BO_3
80. At $25^\circ C$, the molar conductance at infinite dilution for the strong electrolytes NaOH, NaCl and $BaCl_2$ are 248×10^{-4} , 126×10^{-4} and $280 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$ respectively. $\Delta_m^0 Ba(OH)_2$ in $\text{Sm}^2 \text{ mol}^{-1}$ is
- (a) 52.4×10^{-4} (b) 524×10^{-4}
 (c) 402×10^{-4} (d) 262×10^{-4}

PART- III (A) ENGLISH PROFICIENCY

81. (1) If Socrates

(P) innocent St. Joan was at

(Q) the age of seventy

(R) it may be imagined how

(S) was innocent at

(6) the age of seventeen

The correct sequence should be

Options:

- | | |
|----------|----------|
| (a) QRSP | (b) RPSQ |
| (c) PRSQ | (d) SQRP |

82. (1) It was all

(P) that seemed

(Q) and glamorous here

(R) very wonderful

(S) in the old places

(6) so ordinary

The correct sequence should be

Options:

- | | |
|----------|----------|
| (a) QSPR | (b) SPRQ |
| (c) RQSP | (d) PRSQ |

83.

(1) If you feed a dog or tame a bear by hand,

(P) or until they succeed in getting it

(Q) and tear and pull at it.

(R) they get their teeth into the meat

(S) until they bite a piece off,

(6) all out of your hand.

The correct sequence should be

Options:

- | | |
|----------|----------|
| (a) PSRQ | (b) SQRP |
| (c) RPSQ | (d) RQSP |

84. the earth..... round the Sun.

- | | |
|-----------|------------|
| (a) move | (b) moves |
| (c) moved | (d) moving |

85. I..... him only one letter up to now.

- | | |
|-----------------------|----------------|
| (a) sent | (b) have sent |
| (c) have been sending | (d) shall send |

86. I shall telephone you when he.....back.

- | | |
|----------------|------------|
| (a) comes | (b) coming |
| (c) shall come | (d) came |

87. Amenities

- (a) pageantries (b) privileges
(c) facilities (d) courtesies

88. Deflect

- (a) cheat (b) frustrate
(c) pervert (d) depress

89. Exorbitant

- (a) odd (b) ridiculous
(c) excessive (d) threatening

90. He is not in the office..... moment.

- (a) from (b) with
(c) for (d) at

91. She is very affectionate..... her children.

- (a) upon (b) with
(c) towards (d) over

92. People were alarmed (d).....the tiger.

- (a) at (b) in
(c) on (d) for

93. Our world has heritage of culture means

- (a) a richness of tradition
(b) an inherited cultural tradition
(c) too many cultural
(d) cultures which are now extinct

94. 'The less active and important people' are the

- (a) lazy people
(b) uncommitted people
(c) common people
(d) people who are in position of power

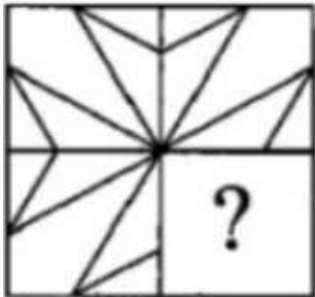
95. "Men ignorant of the past" means' the persons who

- (a) do not learn from experience
(b) ignore the lessons of history

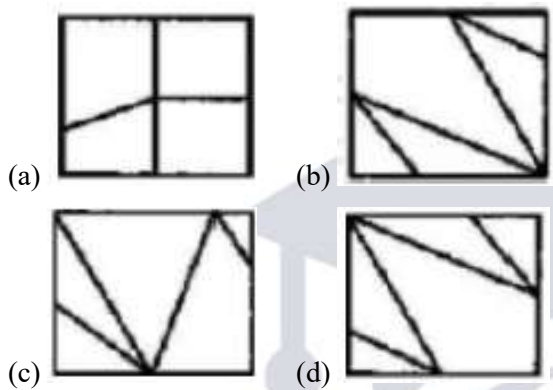
- (c) are not aware of history.
(d) have no respect for the past

PART-III (B) LOGICAL REASONING

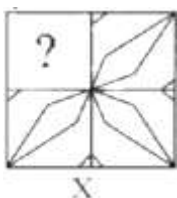
96. Question figure



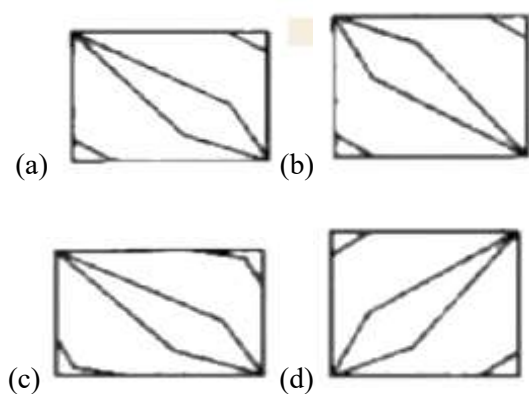
Answer figure



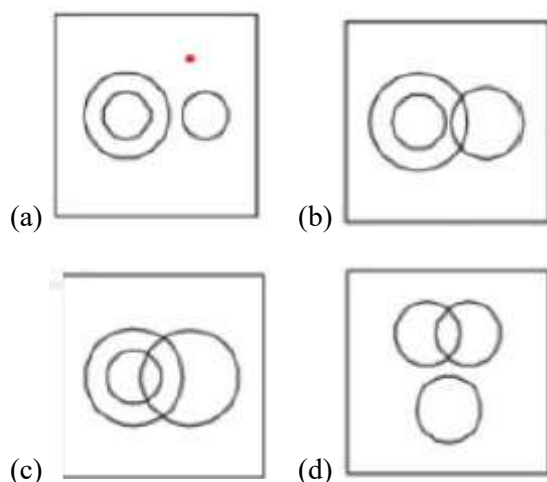
97. Question figure



Answer Figures:

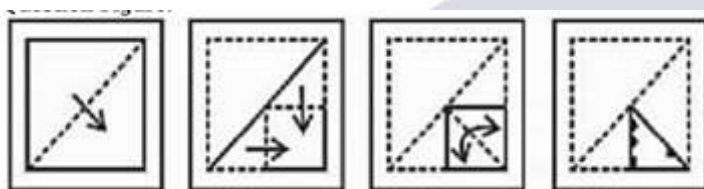


- 98. Identify the diagram that best represents the relationship among the given classes.**
Rose, Flower, Stone

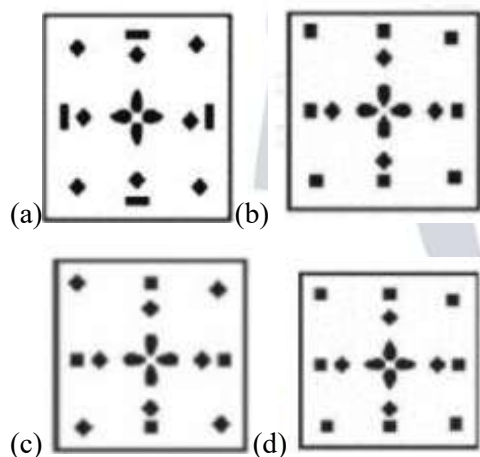


99. A piece of paper is folded and punched as shown below in the question figures. From the given answer figures, indicate how it will appear when opened

Question Figure:



Answer figure



100. Which of the following indicates similar relationship as PNLJ: 2468, then QOKL: ?

- (a) 3591 (b) 1367
(c) 1276 (d) 1376

101. A series is given, with one term missing. Choose the correct alternative from the given ones that will complete the series.

B – 1, D – 2, F – 4, H – 8, J – 16, ?

- (a) K – 64 (b) L – 32
(c) M – 32 (d) L – 64

102. In the word FLOURISH, all the vowels are first arranged alphabetically and then all the consonants are arranged alphabetically and then all the vowels are replaced by the previous letter and all the consonants are replaced by the next letter from the English alphabet. Which letter will be third from the right end?

- (a) I (b) S
(c) M (d) V

103. In a joint family, there are father, mother, 3 married sons and one unmarried daughter. Of the sons two married son have 2 daughters each, and one has a son. How many female members are there in the family?

- (a) 2 (b) 3
(c) 6 (d) 9

104. Choose the cube which will be formed on folding the given question figure.

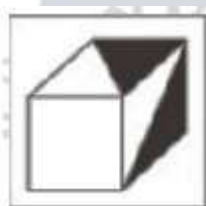
Question Figures:



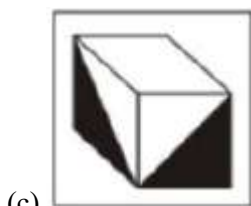
Answer Figures:



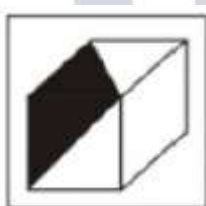
(a)



(b)



(c)



(d)

105. In the following question, select the number which can be placed at the sign of question mark (?) from the given alternatives.

1	$\frac{1}{2}$	$\frac{3}{2}$
2	$\frac{2}{3}$	$\frac{8}{3}$
3	?	$\frac{19}{5}$

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

- (c) $\frac{3}{4}$ (d) $\frac{4}{5}$

PART- IV MATHEMATICS

106. If the sum of a certain number of terms of the AP. 25, 22, 19, ... is 116 then the last term is

- (a) 0 (b) 2
(c) 4 (d) 6

107. The distance between the parallel lines $3x - 4y + 7 = 0$ and $3x - 4y + 5 = 0$ is $\frac{a}{b}$. Value of $a + b$ is

- (a) 2 (b) 5
(c) 7 (d) 3

108. Value of $\lim_{x \rightarrow 0} \frac{a^{\sin x} \sin x}{\sin}$

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

109. If $\int \frac{\sin x}{\sin(x-\alpha)} dx = Ax + B \log \sin(x-\alpha) + C$, then value of (A, B) is

- (a) $(-\cos \alpha, \sin \alpha)$ (b) $(\cos \alpha, \sin \alpha)$
(c) $(-\sin \alpha, \cos \alpha)$ (d) $(\sin \alpha, \cos \alpha)$

110. The domain of the function $f(x) = \frac{1}{\sqrt{x^{12} - x^9 + x^4 - x + 1}}$ is given by

- (a) $(-\infty, -1)$ (b) $(1, \infty)$
(c) $(-1, 1)$ (d) $(-\infty, \infty)$

111. The eccentricity of the ellipse whose major axis is three times the minor axis is:

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

112. The sum of all odd numbers between 1 and 1000 which are divisible by 3 is

- (a) 83667 (b) 90000
(c) 83660 (d) None of these

113. How many numbers lying between 999 and 10000 can be formed with the help of the digits 0, 2, 3, 6, 7, 8, when the digits are not repeated?

- (a) 100 (b) 200
(c) 300 (d) 400

114. The points (0, 7, 10), (-1, 6, 6) and (-4, 9, 6) form

- (a) a right angled isosceles triangle
- (b) a scalene triangle
- (c) a right angled triangle
- (d) an equilateral triangle

115. Find the value of a such that the sum of the squares of the roots of the equation $x^2 - (a - 2)x - (a + 1) = 0$ is least.

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

116. The value of $\int \cos(\log x) dx$ is:

- (a) $\frac{1}{2} [\sin(\log x) + \cos(\log x)] + C$
- (b) $\frac{x}{2} [\sin(\log x) + \cos(\log x)] + C$
- (c) $\frac{x}{2} [\sin(\log x) - \cos(\log x)] + C$
- (d) $\frac{1}{2} [\sin(\log x) - \cos(\log x)] + C$

117. The length of the perpendicular drawn from the point (3, -1, 11) to the line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ is:

- (a) $\sqrt{29}$
- (b) $\sqrt{33}$
- (c) $\sqrt{53}$
- (d) $\sqrt{66}$

118. If the slope of the tangent to the curve at any point P(x, y) is $\frac{y}{x} - \cos^2 \frac{y}{x}$, then the equation of a curve passing through $(1, \frac{\pi}{4})$ is

- (a) $\tan\left(\frac{y}{x}\right) + \log x = 1$
- (b) $\tan\left(\frac{y}{x}\right) + \log y = 1$
- (c) $\tan\left(\frac{x}{y}\right) + \log x = 1$
- (d) $\tan\left(\frac{x}{y}\right) + \log y = 1$

119. If $y = \frac{2\sin \alpha}{1 + \cos \alpha + \sin \alpha}$, then value of $\frac{1 - \cos \alpha + \sin \alpha}{1 + \sin \alpha}$ is

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

120. The coefficient of the term independent of x in the expansion of $\left(\sqrt{\frac{x}{3}} + \frac{3}{2x^2}\right)^{10}$ is

- (a) $\frac{5}{4}$
- (b) $\frac{7}{4}$
- (c) $\frac{9}{4}$
- (d) None of these

121. If $2^x + 2^y = 2^{x+y}$, then $\frac{dy}{dx} =$

- (a) $2^{x-y} \frac{2^y - 1}{2^x - 1}$
- (b) $2^{x-y} \left(\frac{2^y - 1}{1 - 2^x}\right)$

- (c) $\frac{2^x+2^y}{2^x-2^y}$ (d) None of these

122. If $x = \frac{1-t^2}{1+t^2}$ and $y = \frac{2t}{1+t^2}$, then $\frac{dy}{dx}$ is equal to:

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

123. The points at which the tangent passes through the origin for the curve $y = 4x^3 - 2x^5$ are

- (a) (0,0), (2,1) and (-1,-2)
(b) (0,0), (2,1) and (-2,-1)
(c) (2,0), (2,1) and (-3,1)
(d) (0,0), (1,2) and (-1,-2)

124. If the radius of a sphere is measured as 9 cm with an error of 0.03 cm, then find the approximating error in calculating its volume.

- (a) $2.46\pi\text{cm}^3$ (b) $8.62\pi\text{cm}^3$
(c) $9.72\pi\text{cm}^3$ (d) $7.6\pi\text{cm}^3$

125. If z is a complex number such that $z^2 = (\bar{z})^2$, then

- (a) z is purely real
(b) z is purely imaginary
(c) either z is purely real or purely imaginary
(d) None of these

126. $\int_{-a}^4 (x^8 - x^4 + x^2 + 1)dx = 2\int_0^4 (x^8 - x^4 + x^2 + 1)dx$ then $a =$

- (a) 3 (b) 4
(c) 6 (d) 8

127. The area bounded by the curves $x + 2y^2 = 0$ and $x + 3y^2 = 1$ is

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

128. $\frac{d}{dx} \tan^{-1} \Re \left[\frac{1+\cos \frac{x}{2}}{1-\cos \frac{x}{2}} \right]$ is equal to

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

129. $f(x) = \left(\frac{e^{2x}-1}{e^{2x}+1}\right)$ is

- (a) an increasing function (b) a decreasing function
(c) an even function (d) None of these

130. Evaluate: $\int_0^{\pi} \frac{1}{5+4\cos x} dx$

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

131. The equation of the circle, which touches the line $y = 5$ and passes through $(-1, 2)$ and $(1, 2)$ is

- (a) $9x^2 + 9y^2 - 60y + 75 = 0$
(b) $9x^2 + 9y^2 - 60x - 75 = 0$
(c) $9x^2 + 9y^2 + 60y - 75 = 0$
(d) $9x^2 + 9y^2 + 60x + 75 = 0$

132. Coefficient of x^{13} in the expansion of $(1-x)^5(1+x+x^2+x^3)^4$ is

- (a) 4 (b) 6
(c) 32 (d) 5

133. The general solution of the differential equation $(\tan^{-1} y - x)dy = (1+y^2)dx$ is

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

134. The area bounded by curves $(x-1)^2 + y^2 = 1$ and $x^2 + y^2 = 1$ is

- (a) $\left(\frac{2\pi}{3} - \frac{\sqrt{3}}{2}\right)$ (b) $\frac{2\pi}{3}$
(c) $\frac{\sqrt{3}}{2}$ (d) $\frac{2\pi}{3} + \frac{\sqrt{3}}{2}$

135. Consider an infinite geometric series with first term a and common ratio r . If its sum is 4 and the second term is $\frac{3}{4}$, then:

- (a) $a = \frac{4}{7}, r = \frac{3}{7}$ (b) $a = 2, r = \frac{3}{8}$
(c) $a = \frac{3}{2}, r = \frac{1}{2}$ (d) $a = 3, r = \frac{1}{4}$

136. $\int \frac{e^{x(1+x)}}{\cos^2(e^x)} dx$ equals

- (a) $-\cot(e^{x^x}) + C$ (b) $\tan(xe^x) + C$
(c) $\tan(e^x) + C$ (d) $\cot(e^x) + C$

137. If $A + B + C = \frac{\pi}{2}$ then

- (a) $\tan A \tan B + \tan B \tan C + \tan C \tan A = 1$
- (b) $\cot A + \cot B + \cot C = \cot A \cot B \cot C$
- (c) $\cos 2A + \cos 2B + \cos 2C = 1 + 4 \sin A \sin B \sin C$
- (d) All three are correct

138. $\lim_{x \rightarrow 0} \frac{2 \sin^2 3x}{x^2}$ is equal to:

- (a) 12
- (b) 18
- (c) 0
- (d) 6

139. If the harmonic mean between a and b be H , then the value of $\frac{1}{H-a} + \frac{1}{H-b}$ is

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

140. Girl students constitute 10% of I year and 5% of II year at Roorkee University. During summer holidays 70% of the I year and 30% of II year students are given a project. The girls take turns on duty in canteen. The chance that I year girl student is on duty in a randomly selected day is

- (a) $\frac{3}{17}$
- (b) $\frac{14}{17}$
- (c) $\frac{3}{10}$
- (d) $\frac{7}{10}$

141. If the tangent at $P(1, 1)$ on $y^2 = x(2 - x)^2$ meets the curve again at Q , then Q is

- (a) $(2, 2)$
- (b) $(-1, -2)$
- (c) $\left(\frac{9}{4}, \frac{3}{8}\right)$
- (d) None of these

142. A line makes angles of 45° and 60° with the positive axes of X and Y respectively. The angle made by the same line with the positive axis of Z , is.

- (a) 30° or 60°
- (b) 60° or 90°
- (c) 90° or 120°
- (d) 60° or 120°

143. An ellipse has OB as semi minor axis, F and F^1 its foci and the angle FBF^1 is a right angle. Then the eccentricity of the ellipse is

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

144. The value of $\cos(2\cos^{-1}x + \sin^{-1}x)$ at $x = \frac{1}{5}$ is

- (a) $-\frac{2\sqrt{6}}{5}$ (b) $-2\sqrt{6}$
 (c) $-\frac{\sqrt{6}}{5}$ (d) None of these

145. If $\vec{a}$ is a vector of magnitude 50, collinear with the vector $\vec{b} = 6\hat{i} - 8\hat{j} - \frac{15}{2}\hat{k}$ and makes an acute angle with the positive direction of Z - axis, then $\vec{a}$ is equal to

- (a) $-24\hat{i} + 32\hat{j} + 30\hat{k}$ (b) $24\hat{i} - 32\hat{j} - 30\hat{k}$
 (c) $-12\hat{i} + 16\hat{j} - 15\hat{k}$ (d) $12\hat{i} - 16\hat{j} - 15\hat{k}$

146. The mean and variance of a random variable X having binomial distribution are 4 and 2 respectively, then $P(X = 1)$ is

- (a) $\frac{1}{4}$ (b) $\frac{1}{32}$
 (c) $\frac{1}{16}$ (d) $\frac{1}{8}$

147. The statement p : For any real numbers x, y if $x = y$, then $2x + a = 2y + a$ when $a \in \mathbb{Z}$.

- (a) is true (b) is false
 (c) its contrapositive is not true (d) None of these

148. If $z_1 = \sqrt{2} \left[\cos \frac{\pi}{4} + i \sin \frac{\pi}{4} \right]$ and $z_2 = \sqrt{3} \left[\cos \frac{\pi}{3} + i \sin \frac{\pi}{3} \right]$, then $|z_1 z_2|$ is equal to $\sqrt{m}$. Value of m is

- (a) 6 (b) 3
 (c) 2 (d) 5

149. $\lim_{x \rightarrow 0} \sqrt{\frac{x - \sin x}{x + \sin^2 x}}$ is equal to

- (a) 1 (b) 0
 (c) ∞ (d) None of these

150. If $\int \frac{3x+1}{(x-3)(x-5)} dx = \int \frac{-5}{(x-3)} dx + \int \frac{B}{(x-5)} dx$

then the value of B is

- (a) 3 (b) 4
 (c) 6 (d) 8