MHT CET 2026 PCM Apr 13 Shift 2 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 180 Minutes **Total Questions: 150** **Maximum Marks: 200**

General Instructions

(i) This **PCM** paper is from **MHT CET 2026**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

(ii) Answer all **150 multiple choice questions**: **50 Physics**, **50 Chemistry** and **50 Mathematics**.

(iii) Each question offers **four choices**, with **one correct answer**.

(iv) Allow **90 minutes for Physics and Chemistry together**, followed by **90 minutes for Mathematics**. The first group closes before the second opens.

(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

(vi) There is **no negative marking**. Unanswered questions score zero.

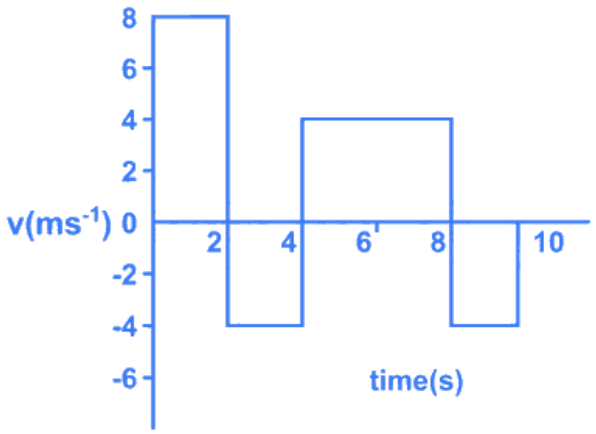
1. The length of a cylinder is measured with a meter rod having least count 0.1 cm. Its diameter is measured with vernier calipers having least count 0.01 cm. Length of cylinder is 8.0 cm and radius is 4.0 cm. Find the percentage error in the calculated value of the volume.

(A) 1.25%
(B) 1.75%
(C) 1.5%
(D) 2.75%

2. Calculate the values of a and b if vectors $a\hat{i}+b\hat{j}=\hat{n}$ and $(\hat{i}+\hat{j})$ are perpendicular to each other

(A) $\frac{1}{2},\frac{1}{2}$
(B) $0,0$
(C) $\sqrt{2},-\frac{1}{\sqrt{2}}$
(D) $\left(\frac{1}{\sqrt{2}}\right),\left(-\frac{1}{\sqrt{2}}\right)$

3. The velocity time graph of a body moving in a straight line is shown in a figure. The ratio of displacement to distance travelled by the body in time 0 to 10 s is



(A) 1 : 1
(B) 1 : 4
(C) 1 : 2
(D) 1 : 3

4. Spherical insulating ball and a spherical metallic ball of same size and mass are dropped from the same height. Choose the correct statement out of the following {Assume negligible air friction}

(A) Time taken by them to reach the earth's surface will be independent of the properties of their materials.
(B) Insulating ball will reach the earth's surface earlier than the metal ball.
(C) Both will reach the earth's surface simultaneously.
(D) Metal ball will reach the earth's surface earlier than the insulating ball.

5. 100 balls each of mass m moving with speed v simultaneously strike a wall normally and reflected back with same speed, in time t s. The total magnitude of force exerted by the balls on the wall is

(A) $100mv/t$
(B) $200mv/t$
(C) $200mvt$
(D) $mv/100t$

6. A solid sphere of mass 1 kg rolls without slipping on a plane surface. Its kinetic energy is 7×10^{-3} J. The speed of the center of mass of the sphere in cm s^{-1} is

(A) 1
(B) 10
(C) 100
(D) 1000

7. Moment of inertia of a disc of mass M and radius 'R' about any of its diameter is $MR^2/4$. The moment of inertia of this disc about an axis normal to the disc and passing through a point on its edge will be, $(x/2)MR^2$. The value of x is

(A) 1
(B) 3
(C) 5
(D) 7

8. A thin uniform rod of length 2 m cross-sectional area 'A' and density 'd' is rotated about an axis passing through the centre and perpendicular to its length with angular velocity ω. If the value of ω in terms of its rotational kinetic energy E is $(\alpha E/Ad)^{1/2}$, then the value of α is

(A) 2
(B) 3
(C) 4
(D) 5

9. If earth has a mass nine times and radius twice to the planet P. Then $\frac{v_e}{3}\sqrt{x}$ ms^{-1} will be the minimum velocity required by a rocket to pull out of gravitational force of P, where v_e is escape velocity on earth. The value of x is

(A) 2 (B) 3

(C) 18 (D) 1

10. Determine the ratio of surface energy of 1 large drop to 1 small drop, if 1000 small drops combined to form 1 large drop.

(A) 100 : 1 (B) 10 : 1

(C) 1000 : 1 (D) 1 : 1

11. A spherical drop of liquid splits into 1000 identical spherical drops. If u_i is the surface energy of the original drop and u_f is the total surface energy of the resulting drops, the (ignoring evaporation). $u_f/u_i = (10/x)$. Then value of x is

(A) 1 (B) 3

(C) 7 (D) 9

12. The surface of water in a water tank of cross-section area 750 cm^2 on the top of a house is h m above the tap level. The speed of water coming out through the tap of cross-section area 500 mm^2 is 30 cm/s. At that instant, dh/dt is $y \times 10^{-3}$ m/s. The value of y will be

(A) 2 (B) 3

(C) 4 (D) 5

13. What will be the ratio of rate of radiation of metal sphere at two different temperatures $T_1 = 527^\circ$C and $T_2 = 127^\circ$C

(A) 4 : 1 (B) 16 : 1

(C) 8 : 1 (D) 64 : 1

14. The coefficient of thermal conductivity of a metal rod depends on its

(A) area of cross section (B) mass

(C) material of the rod (D) length used

15. A sample of gas at temperature T is adiabatically expanded to double its volume. The work done by the gas in the process is (given, $\gamma = \frac{3}{2}$):

(A) $W = TR[\sqrt{2} - 2]$ (B) $W = \frac{T}{R}[\sqrt{2} - 2]$

(C) $W = \frac{R}{T}[2 - \sqrt{2}]$ (D) $W = RT[2 - \sqrt{2}]$

16. Energy of a gas/litre is 600 joule, then what will be its pressure?

(A) 4×10^5 N/m^2 (B) 10^5 N/m^2

(C) 6×10^5 N/m^2 (D) 3×10^5 N/m^2

17. According to law of equipartition of energy the molar specific heat of a non rigid diatomic gas at constant volume is

(A) $(9/2)R$ (B) $(5/2)R$

(C) $(3/2)R$ (D) $(7/2)R$

18. Let γ_1 be the ratio of molar specific heat at constant pressure and molar specific heat at constant volume of a mono-atomic gas and γ_2 be the similar ratio of diatomic gas. Considering the diatomic gas molecule as a rigid rotator, the ratio, γ_1/γ_2 is

(A) $27/35$ (B) $35/27$

(C) $25/21$ (D) $21/25$

19. A block is fastened to a horizontal spring. The block is pulled to a distance $x = 10$ cm from its equilibrium position (at $x = 0$) on a frictionless surface from rest. The kinetic energy of the block at $x = 5$ cm is 0.25 J. The spring constant of the spring is nearly (in Nm^{-1})

(A) 63 (B) 65

(C) 67 (D) 50

20. The amplitude of a particle executing SHM is 3 cm. The displacement at which its kinetic energy will be 25% more than the potential energy is (in cm)

(A) 1 (B) 2

(C) 3 (D) 4

21. The velocity of a particle executing SHM varies with displacement (x) as $4v^2 = 50 - x^2$.
The time period of oscillations is $x/7$ s.
The value of x is (Take $\pi = 22/7$)

(A) 82 (B) 84

(C) 88 (D) 90

22. Two waves are represented by the equations, $y_1 = a\sin(\omega t + kx + 0.57)$ m and $y_2 = a\cos(\omega t + kx)$ m, where x is in metre and t is in second. What is the phase difference between them? ($\pi = 3.14$)

(A) 0.57 radian (B) 1.57 radian

(C) 1.25 radian (D) 1.0 radian

23. Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. Which of the following is correct about the wavelength of a 700 Hz accoustic wave as it enters brass from warm air?

(A) It increase by a factor 20
(B) It decrease by a factor 10
(C) It increase by a factor 10
(D) It decrease by a factor 20

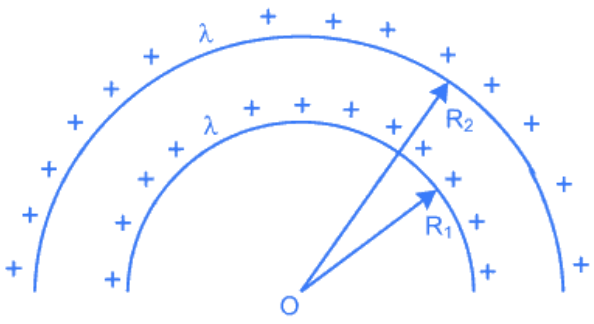
24. The distance between two consecutive points with phase difference of 60° in a wave of frequency n is x meter. The velocity with which wave is traveling is

(A) nx
(B) $2nx$
(C) $3nx$
(D) $6nx$

25. A traveling wave is described by the equation $y(x,t) = [0.05\sin(8x - 4t)]$ m
The velocity of the wave is [All the quantities are in SI unit]

(A) 4 ms^{-1}
(B) 2 ms^{-1}
(C) 0.5 ms^{-1}
(D) 8 ms^{-1}

26. The electric potential at the center of two concentric half rings of radii R_1 and R_2, having same linear charge density λ is (ϵ_0 = permittivity of free space)



(A) $2\lambda/\epsilon_0$
(B) $\lambda/2\epsilon_0$
(C) $\lambda/4\epsilon_0$
(D) λ/ϵ_0

27. If two charges q_1 and q_2 are separated with distance 'd' and placed in a medium of dielectric constant K. What will be the equivalent distance between charges in air for the same electrostatic force?

(A) $d[k]^{1/2}$
(B) $k[d]^{1/2}$
(C) $1.5d[k]^{1/2}$
(D) $2d[k]^{1/2}$

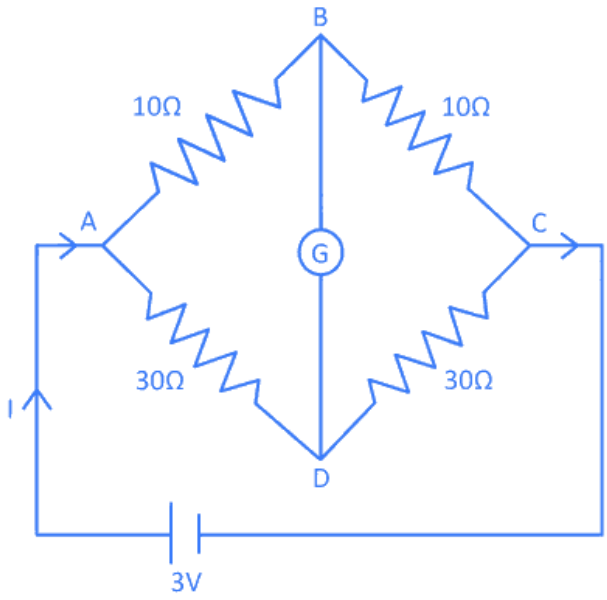
28. Two isolated metallic spheres of radii R and $2R$ are charged such that both have the same charge density σ. The spheres are then connected by a thin conducting wire. If the new charge density of the larger sphere is σ_1. The ratio σ_1 to σ is

(A) 9 : 4
(B) 4 : 3
(C) 5 : 3
(D) 5 : 6

29. A parallel plate capacitor with air between the plate has a capacitance of 15 pF. The separation between the plates becomes twice and the space between them is filled with a medium of dielectric constant 3.5. Then the capacitance becomes $x/4$ pF.
The value of x is

(A) 105
(B) 109
(C) 111
(D) 115

30. Resistances are joint as shown in the figure. In the balanced condition, the current I drawn from the battery is



(A) 0.1 A
(B) 0.15 A
(C) 0.2 A
(D) 0.25 A

31. In an experiment to find emf of a cell using potentiometer, the length of null point for a cell of emf 1.5 V is found to be 60 cm. If this cell is replaced by another cell of emf E, the length of null point increases by 40 cm. The value of E is $x/10$ V.
The value of x is

(A) 20
(B) 25
(C) 28
(D) 30

32. A charged particle q is accelerated by a potential difference of V enters a region of uniform magnetic field of induction B at right angles to the direction of the field. The charged particle completes semi circle of the radius r inside the magnetic field. The mass of the charged particle is (all quantities are in SI units)

(A) $q^2r^2B^2/2V$ (B) $qr^2B^2/2V$

(C) qBr/V (D) $q^2r^2B/2V$

33. Two long straight wires are arranged parallel to each other and are kept 20 cm apart in vacuum. They carry currents of 2 A and 4 A respectively in the same direction. What will be the magnetic force on a length of 10 cm of either wire?
($\mu_0 = 4\pi \times 10^{-7}$ SI units)

(A) 10^{-7} N (B) 2×10^{-7} N

(C) 4×10^{-7} N (D) 8×10^{-7} N

34. A rod with a circular cross-section area 2 cm^2 and length 40 cm is wound uniformly with 400 turns of an insulated wire. If a current 0.4 A flows in the wire winding, the total magnetic flux produced inside the winding is $4\pi \times 10^{-6}$ Wb. The relative permeability of the rod is
(Given permeability of vacuum $\mu_0 = 4\pi \times 10^{-7}$ N m A^{-2})

(A) 12.5 (B) 32/5

(C) 125 (D) 5/16

35. The magnetic moments associated with two closely wound circular coils a and b of radius r and $2r$ respectively are equal if (where N_a, I_a and N_b, I_b are number of turns and current in A and B respectively)

(A) $2N_aI_a = N_bI_b$ (B) $N_a = 2N_b$

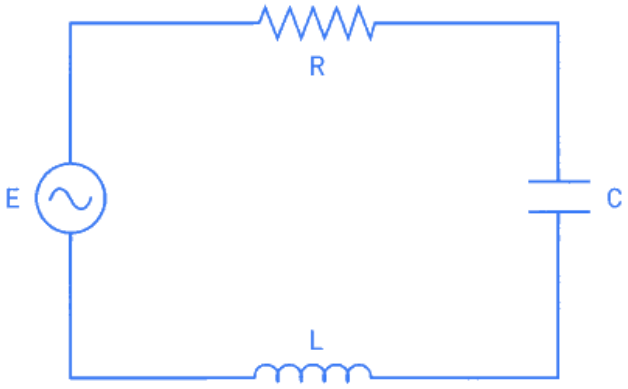
(C) $N_aI_a = 4N_bI_b$ (D) $4N_aI_a = N_bI_b$

36. A conducting loop of radius $10/[\pi]^{1/2}$ cm is placed perpendicular to a uniform magnetic field 0.5 T. The magnetic field is decreased to zero in 0.5 s at a steady rate. The induced emf in the circular loop at 0.25 s is

(A) 1 mV (B) 10 mV

(C) 100 mV (D) 5 mV

37. In the circuit shown, the ratio of the quality factor and the band width is
(Given: band width = R/L)



(A) $\sqrt{\frac{1}{LC}\frac{L^2}{R^2}}$ (B) $\sqrt{\frac{1}{LC}}$

(C) $\sqrt{\frac{1}{LC}\frac{L}{R}}$ (D) $\sqrt{\frac{1}{LC}\frac{R}{L}}$

38. An inductor of 0.5 mH, a capacitor of 20 μF and resistance 20 Ω are connected in series with a 220 V ac source. If the current is in phase with the emf, the amplitude of current of the circuit is $[x]^{1/2}$ A. The value of x is

(A) 61 (B) 121

(C) 242 (D) 442

39. In a series LR circuit with $X_L = R$. Power factor is P_1. If a capacitor of capacitance C with $X_c = X_L$ is added to the circuit the power factor becomes P_2. The ratio of P_1 to P_2 will be :

(A) 1 : 3 (B) 1 : $\sqrt{2}$

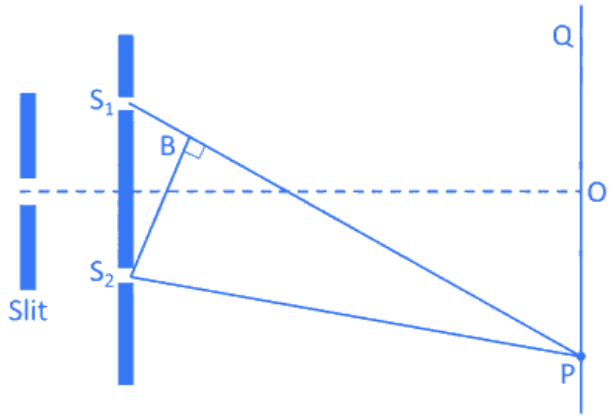
(C) 1 : 1 (D) 1 : 2

40. When a beam of white light is allowed to pass through convex lens parallel to principle axis, the different colors of light converge at different point on the principle axis after refraction. This is called

(A) scattering (B) chromatic aberration

(C) spherical aberration (D) polarisation

41. In Young's double slit experiment, following figure shows that Q is the position of second bright fringe on the right side of point O. P is the eleventh bright fringe on the other side measured from point Q. If the wavelength of light used is 6000 Ã_x0085_, then what will be the value of S_1B?



(A) 3.142×10^{-7} m
(B) 3.138×10^{-7} m
(C) 6.6×10^{-6} m
(D) 5.4×10^{-6} m

42. 'n' polarizing sheets are arranged such that each makes an angle 45° with the preceding sheet. An unpolarized light of intensity I is incident into this arrangement. The output intensity is found to be $I/64$. The value of n will be

(A) 3
(B) 6
(C) 5
(D) 4

43. In Young's double slit experiment, two slits S_1 and S_2 are 'd' distance apart and the separation from slits to screen is D. Now if two transparent slabs of equal thickness 0.1 mm but refractive index 1.51 and 1.55 are introduced in the path of beam ($\lambda = 4000$ Ã_x0085_) from S_1 and S_2 respectively. The central bright fringe spot will shift by ___ number of fringes.

(A) 5
(B) 10
(C) 15
(D) 20

44. The threshold frequency of metal is f_0. When the light of frequency $2f_0$ is incident on the metal plate, the maximum velocity of photoelectron is v_1. When the frequency of incident radiation is increased to $5f_0$ the maximum velocity of photoelectrons emitted is v_2. The ratio v_1 to v_2 is

(A) 1 : 2
(B) 1 : 8
(C) 1 : 16
(D) 1 : 4

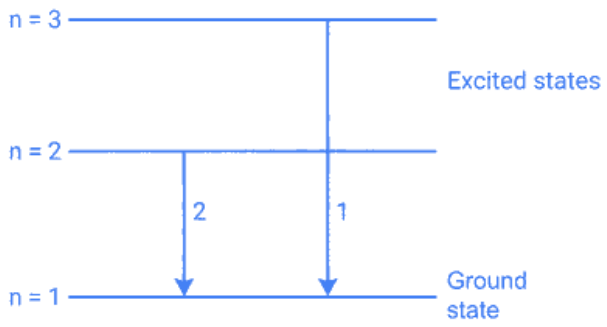
45. An electron accelerated through a potential difference V_1 has a de-Broglie wavelength of λ. When the potential is changed to V_2, its de-Broglie wavelength increases to 2λ. The value of (V_1/V_2) is equal to

(A) 3 : 1
(B) 9 : 4
(C) 3 : 2
(D) 4 : 1

46. The wavelength of the radiation emitted is λ_0 when an electron jumps from the second excited state to the first excited state of hydrogen atom. If the electron jumps from the third excited state to the second orbit of the hydrogen atom, the wavelength of the radiation emitted will be $(20\lambda_0/x)$. The value of x is

(A) 17
(B) 21
(C) 27
(D) 29

47. For hydrogen atom, λ_1 and λ_2 are the wavelengths corresponding to the transitions 1 and 2 respectively as shown in figure. The ratio of λ_1 and λ_2 is $x/32$. The value of x is



(A) 13
(B) 27
(C) 29
(D) 35

48. A pure silicon crystal at temperature 300 K has electron and hole concentration (n_i) 10^{16} per m^3 each and 10^{21} phosphorus atoms (n_e) are added per cubic metre. The new hole concentration in silicon crystal is

(A) 10^{19} per m^3
(B) 10^{21} per m^3
(C) 10^5 per m^3
(D) 10^{11} per m^3

49. If transistor having $\alpha = 0.9$, is used in CE configuration, then for a change of 0.4 mA in base current, what will be the change in collector current?

(A) 3.6 mA
(B) 4 mA
(C) 0.9 mA
(D) 36 mA

50. Choose the correct statement about Zener diode:

(A) It works as a voltage regulator in reverse bias and behaves like simple pn junction diode in forward bias.

(B) It works as a voltage regulator in both forward and reverse bias.

(C) It works a voltage regulator only in forward bias.

(D) It works as a voltage regulator in forward bias and behaves like simple pn junction diode in reverse bias.

51. 1 g of H_2 contains the same number of molecules as in

(A) 14 g of N_2 (B) 18 g of H_2O

(C) 16 g of CO (D) 28 g of N_2

52. If the energy of an electron in the first Bohr orbit of the H-atom is -2.18×10^{-18} J then the energy of the electron in the second orbit will be

(A) -2.18×10^{-18} J (B) -4.36×10^{-18} J

(C) -0.545×10^{-18} J (D) -0.273×10^{-18} J

53. In the compound ${}^{1}CH_2 = {}^{2}CH - {}^{3}CH_2 - {}^{4}CH_2 - {}^{5}C \equiv {}^{6}CH$, The $C_2 - C_3$ bond is of type

(A) $sp - sp^2$ (B) $sp^3 - sp^3$

(C) $sp - sp^3$ (D) $sp^2 - sp^3$

54. A gas occupies a volume of 0.35 dm^3 at 290 K and 2 atm. Pressure. Calculate the volume of gas at STP.

(A) 3.11 dm^3 (B) 0.66 dm^3

(C) 0.11 dm^3 (D) 3.5 dm^3

55. The enthalpy of combustion of cyclohexane, cyclohexene and H_2 are respectively $-3920, -3800$ and -241 KJ mol^{-1}. The enthalpy of hydrogenation of cyclohexene is

(A) -121 KJ mol^{-1} (B) $+121$ KJ mol^{-1}

(C) -242 KJ mol^{-1} (D) $+242$ KJ mol^{-1}

56. A gas expands from a volume of 1 dm^3 to 1.25 dm^3 under a pressure of 1 bar. Find the change in internal energy if 150 J of heat is supplied to the system.

(A) 125 J (B) 175 J

(C) -125 J (D) -175 J

57. In which of the following processes the internal energy of system remain constant?

(A) Isobaric Process (B) Isochoric Process

(C) Isothermal Process (D) Adiabatic Process

58. Match **List I** with **List II**

List I (Buffers)	**List II (Applications)**
(A) $HCO_3^{-1} + H_2CO_3$	(I) Maintain the pH of blood forms 7.36 to 7.42
(B) Phosphates	(II) In Medicine
(C) Sodium Citrate	(III) In Qualitative analysis of basic radicals
(D) $NH_4Cl + NH_4OH$	(IV) In fertilizers

Choose the **correct** answer from the options given below:

(A) (A) - (I), (B) - (II), (C) - (III), (D) - (IV) (B) (A) - (II), (B) - (IV), (C) - (I), (D) - (III)

(C) (A) - (I), (B) - (IV), (C) - (II), (D) - (III) (D) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

59. Find the pH of a solution formed by mixing equal volume of solution of 0.1 M sodium propionate and 0.1 molar propionic acid.
(Given The dissociation constant of propionic acid is 1.3×10^{-5})

(A) 2.45 (B) 4.89

(C) 5.98 (D) 6.89

60. What is the concentration of hydrogen ion in the solution when the concentration of hydroxyl ion is 0.08 mol / dm^3 at 298 K ?

(A) 0.125 mol/L (B) 0.125×10^{-12} mol/L

(C) 0.0125 mol/L (D) 0.125×10^{-10} mol/L

61. What is oxidation state of oxygen in OF_2 and in KO_2 respectively?

(A) $+2$ and $+1$ (B) $+2$ and $-1/2$

(C) $+1$ and $-1/2$ (D) -2 and -1

62. Which of the following ions are responsible for hardness of water?

(A) Ag^+, Au^{3+} ions (B) Hg^{2+}, Pb^{2+} ions

(C) Ca^{2+} and Mg^{2+} ions. (D) As^{3+}, CN^-

63. Identify the elements of alkali metals and alkaline earth metals respectively having highest 1st ionization enthalpy.

(A) K and Ca
(B) Li and Be
(C) Rb and Ba
(D) K and Sr

64. What is the nature of Al_2O_3?

(A) Acidic
(B) Basic
(C) Amphoteric
(D) Neutral

65. Which of the following is correct decreasing order of acidic strength for the compounds listed below?
I: p-chlorophenol, II: p-Cresol, III: p-nitrophenol, IV: p-methoxyphenol.

(A) II > IV > I > III
(B) I > II > III > IV
(C) III > I > II > IV
(D) IV > III > I > II

66. Among the following, the most stable carbocation is

(A) CH_3^+
(B) $(CH_3)_2CH^+$
(C) CH_3-CH_2^+
(D) $(CH_3)_3C^+$

67. What is the product of decarboxylation of anhydrous sodium benzoate?

(A) Benzene
(B) Cyclohexane
(C) Benzene hexachloride
(D) Chlorobenzene

68. An ionic compound is formed by elements X and Y. Element Y forms a face-centered cubic (FCC) lattice, and element X occupies one-third of the tetrahedral voids. What is the formula of the compound?

(A) X_2Y_3
(B) XY
(C) XY_3
(D) X_2Y

69. A metal crystallizes to form simple cubic unit cell. Calculate the void volume of unit cell. [$a = 3.36 \times 10^{-8}$ cm]

(A) 1.807×10^{-23} cm^3.
(B) 1.214×10^{-23} cm^3.
(C) 3.662×10^{-23} cm^3.
(D) 1.986×10^{-23} cm^3.

70. Which from following ionic crystals exhibits Frenkel defect?

(A) ZnS
(B) NaCl
(C) KCl
(D) KBr

71. An aqueous solution has an osmotic pressure of 4.92 atm at 300 K.
Calculate the molarity of the solution.
($R = 0.082$ L atm mol^{-1} K^{-1})

(A) 0.1 M
(B) 0.2 M
(C) 0.25 M
(D) 0.4 M

72. A solution is prepared by dissolving 68 g sucrose in 1 kg water. Calculate the vapour pressure of solution at 298 K. [vapour pressure of water at 298 K = 18 mm of Hg & mole fraction of solvent = 0.9964]

(A) 17.93 mm Hg
(B) 17.80 mm Hg
(C) 17.76 mm Hg
(D) 17.68 mm Hg

73. Which of the following statements is NOT true about solubility?

(A) The solubility of gases in water usually decreases with increase of temperature.
(B) The solubility of gases in water usually increases with increase in pressure.
(C) The substances having similar intermolecular forces are likely to be soluble in each other.
(D) Gases like NH_3 and CO_2 obey Henry's law

74. Which of the following reaction is possible at anode?

(A) $F_2 + 2e^- \rightarrow 2F^-$
(B) $2H^+ + \frac{1}{2}O_2 + 2e^- \rightarrow H_2O$
(C) $Fe^{2+} \rightarrow Fe^{3+} + 1e^-$
(D) $Cu^{2+} + 2e^- \rightarrow Cu(s)$

75. Which of the following statements is correct regarding the cathode of electrochemical cell ?

(A) Oxidation occurs at the cathode
(B) Reduction occurs at cathode
(C) Usually denoted by a negative sign
(D) Is usually made up of non conducting material.

76. Which of the following solutions will have the highest electrical conductivity?

(A) Distilled water
(B) Sugar solution
(C) Salt solution
(D) Alcohol solution

77. A first order reaction takes 16 minutes for it's 50% completion. What fraction that would react in 32 minutes from the beginning?

(A) $1/2$ (B) $1/4$
(C) $1/8$ (D) $3/4$

78. The half-life of a first-order reaction is 20 minutes. What is the rate constant (in min^{-1}) for this reaction?

(A) 0.0347 (B) 0.5
(C) 13.86 (D) 34.67

79. The rate constant of a reaction is $k = 3.28 \times 10^{-4}$ s^{-1}. Find the order of the reaction.

(A) Zero order (B) First order
(C) Second order (D) Third order

80. Which of the following is a water-in-oil type of emulsion?

(A) Milk (B) Vanishing Cream
(C) Paint (D) Butter

81. What is O-O bond length in ozone ?

(A) 178 pm (B) 128 pm
(C) 256 pm (D) 483 pm

82. Which of the following ions exhibit same value of spin only magnetic moment?
(A). Ti^{3+}
(B). Cr^{3+}
(C). Mn^{2+}
(D). Fe^{3+}
(E). Sc^{3+}
Choose the most appropriate answer from the options given below.

(A) (B) and (D) only (B) (A) and (E) only
(C) (C) and (D) only (D) (A) and (D) only

83. Which of the following cations in their oxidation states forms colored compounds ?

(A) Sc^{3+} (B) Ti^{4+}
(C) Cu^{+} (D) V^{3+}

84. Which of the following statements is correct with respect to $[Mn(CN)_6]^{3-}$?

(A) It is sp^3d^2 hybridised and tetrahedral.
(B) It is d^2sp^3 hybridised and octahedral.
(C) It is dsp^2 hybridised and square planar
(D) It is sp^3d^2 hybridised and octahedral.

85. What is the importance of Sandmeyer's reaction?

(A) To obtain R-I from R-Cl
(B) To obtain Ar-X by replacing diazo group of AR-N_2^+-X^- using CuCl / HCl
(C) To obtain R-F from R-Cl using AgF
(D) To obtain R-CH_2-R from R-CO-R using Zn-Hg / HCl

86. Which of the following favors SN^1 reaction?

(A) Strong nucleophile (B) Non - Polar solvent
(C) Bulky alkyl groups on the carbon atom attached to halogen atom
(D) Small alkyl groups on the carbon atom attached to halogen atom

87. How many moles of hydrogen are liberated when 6 moles of ethyl alcohol reacts with sodium metal?

(A) 2 (B) 3
(C) 4 (D) 6

88. Find the order of formation of alcohol from alkene from the following.

(A) $3^\circ > 1^\circ > 2^\circ$ (B) $3^\circ > 2^\circ > 1^\circ$
(C) $1^\circ > 2^\circ > 3^\circ$ (D) $1^\circ > 3^\circ > 2^\circ$

89. Which of the following compounds dose NOT respond positively to the iodoform test ?

(A) Acetaldehyde (B) Propan-2-ol
(C) Propanone (D) Pentan-3-one

90. Which of the following compounds can not form iodoform?

(A) Ethyl methyl ketone (B) Isopropyl alcohol
(C) 3-Methyl - 2-butanone (D) Isobutyl alcohol

91. Which is a weakest acid among the following ?

(A) $(CH_3)_2CHCOOH$ (B) CH_3COOH

(C) $ClCH_2COOH$ (D) Cl_3CCOOH

92. Which of the following amines is not obtained by Gabriel phthalimide synthesis?

(A) Aniline (B) Benzyl amine

(C) Methyl amine (D) Isobutyl amine

93. What type of amine is Iso propyl amine ?

(A) primary amine (B) secondary amine

(C) tertiary amine (D) quaternary ammonium salt

94. What is the correct sequence of the complementary strand for the given portion of a DNA molecule:- 5' - G A C G T A C -3' ?

(A) 3' - T T G C A T G - 5' (B) 3' - C T G C A T C - 5'

(C) 3' - C T G C A T G - 5' (D) 3' - C T G T A T G - 5'

95. Which of the following compounds forms starch on polymerization?

(A) α-D-glucose. (B) β-D-glucose.

(C) α-L-glucose (D) β-L-glucose

96. Name the catalyst used in the manufacture of HDPE polymer.

(A) Triethyl aluminum with titanium tetrachloride (B) Triethyl aluminum with zinc chloride

(C) Triethyl aluminum with nickel chloride (D) Triethyl aluminum with stannic chloride

97. Identify the polymer obtained by addition polymerization method from following.

(A) Nylon 6 (B) Dacron

(C) Polythene (D) Nylon 6,6

98. Which of the following is chain growth polymer?

(A) Nylon-6 (B) Teflon

(C) Nylon-66 (D) Terylene

99. Identify the use of Formalin from the followings.

(A) Preservation of biological and anatomical specimens (B) Disinfectant

(C) Beverage (D) Antiseptic

100. Identify the term used for drugs that reduce or relieve pain without causing loss of consciousness.

(A) Analgesic (B) Antipyretic

(C) Antibiotic (D) Antimicrobial

101. The quadratic polynomial $p(x)$ has roots 1 and α, while quadratic polynomial $q(x)$ has roots 1 and β. Let α and β be the roots of $r(x) = p(x) + q(x)$. Then $\lim_{x\to\infty}\left[\sqrt{p(x)} - \sqrt{q(x)}\right] =$

(A) 0 (B) -1

(C) 1 (D) $\frac{1}{2}$

102. If $x = \sqrt{-1 - \sqrt{-1 - \sqrt{-1 - \ldots\infty}}}$, where ω is a non-real complex cube root of unity, then the value of x is...

(A) 1 (B) -1

(C) $-\omega$ (D) ω^2

103. If $\sin 3\alpha = 4\sin\alpha \cdot \sin(x+\alpha) \cdot \sin(x-\alpha)$ where $\alpha \neq n\pi, n \in Z$, then all possible values of x are given as

(A) $x = n\pi \pm \frac{\pi}{3}, n \in Z$ (B) $x = n\pi \pm \frac{\pi}{4}, n \in Z$

(C) $x = n\pi \pm \frac{\pi}{6}, n \in Z$ (D) $x = n\pi \pm \frac{\pi}{2}, n \in Z$

104. If $\cos(\theta - \alpha) = a$ and $\sin(\theta - \beta) = b$, then the value of $\cos^2(\alpha - \beta) + 2ab\sin(\alpha - \beta) + \cos^2(\theta - \alpha)$ is...

(A) $a^2 - 2b^2$ (B) $a^2 + 2b^2$

(C) $2a^2 - b^2$ (D) $2a^2 + b^2$

105. The general solution of $\cos\theta - \sin\theta = 1$ is

(A) $\theta = 2n\pi - \frac{\pi}{2}$ or $\theta = 2n\pi, n \in Z$ (B) $\theta = n\pi - \frac{\pi}{2}$ or $\theta = n\pi, n \in Z$

(C) $\theta = n\frac{\pi}{2} - \pi$ or $\theta = n\frac{\pi}{2}, n \in Z$ (D) $\theta = 2n\pi + \frac{\pi}{2}$ or $\theta = n\pi, n \in Z$

106. The equation of the straight line passing through the point $(-5, 3)$ such that the portion of the line intercepted between the axes is divided by the point in the ratio $4:3$ (from the X-axis to the Y-axis) is...

(A) $9x + 20y + 105 = 0$ (B) $9x - 20y - 105 = 0$

(C) $9x - 20y + 105 = 0$ (D) $9x + 20y - 105 = 0$

107. If the equation $kx^2 - 5xy + 6y^2 + x - 3y = 0$ represents a pair of straight lines, then the co-ordinates of their point of intersection are

(A) $(-3, -1)$ (B) $(-3, 1)$

(C) $(3, -1)$ (D) $(3, 1)$

108. The pair of straight lines represented by the equation $\sqrt{3}x^2 - 4xy + \sqrt{3}y^2 = 0$ are

(A) coincident. (B) perpendicular.

(C) inclined at 30° to each other. (D) inclined at 60° to each other.

109. The equation of the circle concentric with circle $x^2 + y^2 - 6x + 7 = 0$ and which touches the line $x + y + 3 = 0$ is ....

(A) $x^2 + y^2 - 6x + 9 = 0$

(B) $x^2 + y^2 - 6x - 9 = 0$

(C) $x^2 + y^2 - 6x + 3 = 0$

(D) $x^2 + y^2 - 6x - 3 = 0$

110. The distance of the focus of the parabola $y^2 = 16x$ from its directrix is...

(A) 4 (B) 8

(C) 12 (D) 16

111. The value of $\lim_{n\to\infty} \frac{(n+2)! + (n+1)!}{(n+2)! - (n+1)!}$ is

(A) -1 (B) 0

(C) 1 (D) 2

112. If the truth value of the compound statement $[(p \vee q) \wedge (q \to r) \wedge (\sim r)] \to (p \wedge q)$ is false, then the truth values of $p \to q$ and $q \to p$ are respectively...

(A) (F, T) (B) (T, F)

(C) (T, T) (D) (F, F)

113. Which of the following statements is logically equivalent to $\sim (p \leftrightarrow q)$?

(A) $\sim p \to q$ (B) $\sim p \leftrightarrow \sim q$

(C) $\sim (q \to \sim p)$ (D) $p \leftrightarrow \sim q$

114. If $A = \begin{bmatrix} \sec\theta & -\tan\theta \\ -\tan\theta & \sec\theta \end{bmatrix}$, $\theta \in \left(0, \frac{\pi}{2}\right)$ such that $A + adj\ A = 4I$, then $\theta =$

(A) $\frac{\pi}{12}$ (B) $\frac{\pi}{6}$

(C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

115. The element in 1st row and 2nd column of the inverse of the matrix $\begin{bmatrix} 1 & 3 & -2 \\ -3 & 0 & -5 \\ 2 & 5 & 0 \end{bmatrix}$ is ...

(A) $-\frac{2}{5}$ (B) $-\frac{10}{3}$

(C) $-\frac{2}{25}$ (D) $\frac{1}{25}$

116. If

$y = \tan^{-1}\left(\frac{1}{x^2+x+1}\right) + \tan^{-1}\left(\frac{1}{x^2+3x+3}\right) + \tan^{-1}\left(\frac{1}{x^2+5x+7}\right) + \ ...$

upto n terms, then $y'(0) =$

(A) $\frac{n^2}{n^2+1}$ (B) $-\frac{n^2}{n^2+1}$

(C) 0 (D) $\frac{1}{n^2+1}$

117. Let $f(x) = (\sin^{-1}x)^2 + (\cos^{-1}x)^2$ be a real-valued function defined on its domain. Then the sum of the greatest and the least values of $f(x)$ is

(A) $\frac{\pi^2}{8}$ (B) $\frac{11\pi^2}{8}$

(C) $\frac{3\pi^2}{8}$ (D) $\frac{7\pi^2}{8}$

118. The value of $\frac{\tan^{-1}(1) + \cos^{-1}\left(\frac{1}{2}\right) + \sin^{-1}\left(\frac{1}{2}\right)}{\tan^{-1}(\sqrt{3}) - \sec^{-1}(-2)}$ is equal to

(A) $\frac{3}{4}$ (B) $\frac{-1}{3}$

(C) -4 (D) $\frac{-9}{4}$

119. If $g(x)$ is the inverse function of $f(x)$, where $f(x) = \frac{5x+3}{4x-1}$, then $g(1) =$

(A) -4 (B) $\frac{-1}{4}$

(C) $\frac{8}{3}$ (D) $\frac{3}{8}$

120. If $f(x)$ is continuous at $x = 0$, where $f(x) = \frac{8^x - 2^x}{k^x - 1}$, for $x \neq 0$ and $f(0) = 2$, then the value of k is ...

(A) 0 (B) 4

(C) -2 (D) 2

121. $\frac{d}{dx}\left[\sin^2\left\{\cot^{-1}\sqrt{\frac{1-x}{1+x}}\right\}\right] = ...$

(A) -1 (B) $\frac{1}{2}$

(C) $\frac{-1}{2}$ (D) 1

122. If $f(x) = \sqrt{x^2+1}, g(x) = \frac{x+1}{x^2+1}, h(x) = 2x - 3$, then $f'(h'(g'(x))) =$

(A) 0 (B) $\frac{1}{\sqrt{x^2+1}}$

(C) $\frac{2}{\sqrt{5}}$ (D) $\frac{x}{\sqrt{x^2+1}}$

123. If $\sqrt{y+x} + \sqrt{y-x} = c$ such that $\frac{dy}{dx} = f(x) - \sqrt{[f(x)]^2 - 1}$, then $f(x) =$ ____

(A) $\frac{y}{x}$ (B) $-\frac{x}{y}$

(C) $-\frac{y}{x}$ (D) $\frac{x}{y}$

124. If Rolle's theorem is applicable for the function $f(x) = \log\left(\frac{x^2+a}{x}\right)$ on $[3, 4]$ with $c \in (3, 4)$ such that $f'(c) = 0$, then the value of $f''(c)$ is

(A) $\frac{1}{48}$ (B) $\frac{1}{36}$

(C) $\frac{1}{24}$ (D) $\frac{1}{12}$

125. If the tangent to the curve $2y^3 = x^3 + ax^2$ at the point (a, a) cuts off intercepts α and β on the coordinate axes such that $\alpha^2 + \beta^2 = 61$, then the value of a is

(A) ± 61 (B) ± 36

(C) ± 30 (D) ± 25

126. Let $f(x)$ be the differentiable function for all x such that $f'(x) \leq 5$ and $f(1) = 4$. The maximum value of $f(5)$ is...

(A) 16 (B) 20

(C) 24 (D) 25

127. If $\int x^2 \cdot e^x dx = e^x f(x) + c$, then the minimum value of $f(x)$ is ...

(A) 0 (B) -1

(C) 1 (D) $\frac{-1}{4}$

128. $\int \frac{(x+1)}{x(1+xe^x)^2} dx =$

(A) $-\log\left(\frac{xe^x}{1+xe^x}\right) + \frac{1}{(1+xe^x)} + c$

(B) $\log\left(\frac{xe^x}{1+xe^x}\right) + \frac{1}{(1+xe^x)} + c$

(C) $\log\left(\frac{1+xe^x}{xe^x}\right) + (1+xe^x) + c$

(D) $-\log\left(\frac{xe^x}{1+xe^x}\right) - \frac{1}{(1+xe^x)} + c$

129. If $\int \frac{x+1}{x^2+1} dx = \tan^{-1} x + g(x) + c$, where c is constant of integration, then the function $g(x)$ is monotonically increasing in the interval

(A) R^+ (B) R^-

(C) R (D) $R - \{0\}$

130. $\int \sqrt{1+\sin x}\, dx$ is equal to

(A) $2\sqrt{2}\, \sin\left(\frac{x}{2} - \frac{\pi}{4}\right) + c$

(B) $2\sqrt{2} \sin\left(\frac{x}{2} + \frac{\pi}{4}\right) + c$

(C) $\sqrt{2} \sin\left(\frac{x}{2} - \frac{\pi}{4}\right) + c$

(D) $\sqrt{2} \sin\left(\frac{x}{2} + \frac{\pi}{4}\right) + c$

131. If $\int_0^a (x^2 - 4x + 1) dx = 6$, then the real value of a is

(A) 4 (B) 6

(C) 3 (D) -3

132. If $\int_{\pi/6}^{\pi/3} \frac{1}{1+\sin x + \cos x} dx = \log 2$, then the value of $\int_{\pi/6}^{\pi/3} \frac{\cos x}{1+\sin x + \cos x} dx =$ .....

(A) $\frac{\pi}{12} - \frac{1}{2}\log 2$ (B) $\frac{\pi}{12} - \frac{1}{3}\log 2$

(C) $\frac{\pi}{6} - \frac{1}{2}\log 2$ (D) $\frac{\pi}{12} - \frac{1}{4}\log 2$

133. The area of the region bounded by the curve $y = 2^{kx}$ and $x = 0, x = 2$, in first quadrant is $\frac{2}{\log 2}$, then the value of k is

(A) 1 (B) 2

(C) $-\frac{1}{2}$ (D) $\frac{1}{2}$

134. The area of the region bounded by the curve $y = x^3$ and the lines $y = 8$ and $x = 0$ is ... square units.

(A) 8 (B) 12

(C) 16 (D) 10

135. The differential equation of $3y = \sqrt[3]{x+c}$ is

(A) $\frac{dy}{dx} = \frac{1}{9y^2}$ (B) $\frac{dy}{dx} = \frac{1}{27y^2}$

(C) $\frac{dy}{dx} = \frac{1}{81y^2}$ (D) $\frac{dy}{dx} = \frac{1}{36y^2}$

136. The general solution of the differential equation $(x+y)\frac{dy}{dx} = 1$ is

(A) $x + y + 1 = c$, where c is a constant of integration

(B) $x + y + 1 = ce^y$, where c is a constant of integration

(C) $x + y + 1 = ce^{-y}$, where c is a constant of integration

(D) $x + y - 1 = ce^{-y}$, where c is a constant of integration

137. A body cools according to Newton's law of cooling from 100°C to 60°C in 20 minutes. The temperature of the surroundings being 20°C, then the total time required for the body to cool down to 30°C is

(A) 90 minutes (B) 1 hour and 10 minutes

(C) 80 minutes (D) 60 minutes

138. If $\bar{a} = \hat{i} + \hat{j}$ and $\bar{b} = \hat{i} - \hat{k}$, then the point of intersection of the lines $\bar{r} \times \bar{a} = \bar{b} \times \bar{a}$ and $\bar{r} \times \bar{b} = \bar{a} \times \bar{b}$ is

(A) $(2, 1, -1)$ (B) $(2, -1, 1)$

(C) $(0, 1, 1)$ (D) $(0, -1, 1)$

139. If $\bar{a}$ and $\bar{b}$ have the same magnitude and angle between them is 60° and their scalar product is $\frac{1}{2}$, then $|\bar{a}|$ is ____

(A) 2 (B) 3

(C) 7 (D) 1

140. If $\bar{a} = \hat{i} + \hat{j} + \hat{k}, \bar{b} = \hat{i}, \bar{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$ with $c_1 = 1$, $c_2 = 2$, then value of c_3 such that $\bar{a}, \bar{b}, \bar{c}$ are coplanar is ____

(A) 2 (B) -1

(C) 0 (D) -2

141. If $\bar{a}, \bar{b}$ and $\bar{c}$ are non-coplanar unit vectors such that the angle between any two of them is 60°, and the vector $\bar{d} = x\bar{a} + y\bar{b} + z\bar{c}$ is perpendicular to both $\bar{a}$ and $\bar{b}$, then the value of $\frac{(x+y)}{z}$ is

(A) $-\frac{1}{2}$ (B) $-\frac{2}{3}$

(C) -1 (D) 0

142. If $\bar{a}, \bar{b}, \bar{c}$ are three non zero and non-coplanar vectors such that $\bar{a} \times (\bar{b} \times \bar{c}) = \frac{\bar{b}}{2}$, then the angle between $\bar{a}$ and $\bar{b}$ is ...

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$

(C) $\frac{\pi}{2}$ (D) π

143. The vector equation of the plane which is at a distance of 5 units from the origin and normal to the vector $2\hat{i} + \hat{j} - 2\hat{k}$ is

(A) $\vec{r} \cdot (2\hat{i} + \hat{j} - 2\hat{k}) = 12$

(B) $\vec{r} \cdot (2\hat{i} + \hat{j} - 2\hat{k}) = 15$

(C) $\vec{r} \cdot (2\hat{i} + \hat{j} - 2\hat{k}) = 9$

(D) $\vec{r} \cdot (2\hat{i} + \hat{j} - 2\hat{k}) = 18$

144. The equation of a line passing through a point $(4, -2, 3)$ and perpendicular to the XZ-plane is....

(A) $\bar{r} = (4\hat{i} - 2\hat{j} + 3\hat{k}) + \lambda(\hat{i} + \hat{k})$

(B) $\bar{r} = (4\hat{i} - 2\hat{j} + 3\hat{k}) + \lambda(\hat{i})$

(C) $\bar{r} = (4\hat{i} - 2\hat{j} + 3\hat{k}) + \lambda(\hat{j})$

(D) $\bar{r} = (4\hat{i} - 2\hat{j} + 3\hat{k}) + \lambda(\hat{i} - \hat{k})$

145. The equation of the plane passing through the intersection of planes $2x - y + z = 3$, $4x - 3y + 5z = -9$ and parallel to the line $\frac{x+1}{2} = \frac{y+3}{4} = \frac{z-3}{5}$ is...

(A) $11x - 3y - 2z - 54 = 0$

(B) $11x + 3y - 2z - 54 = 0$

(C) $11x - 3y + 2z - 54 = 0$

(D) $11x - 3y - 2z + 54 = 0$

146. If a line makes angles α, β, γ with the coordinate axes, then the sum of values of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ and $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ is ...

(A) 5 (B) 0

(C) 3 (D) 1

147. The difference between the maximum value and minimum value of the objective function $z = 3x + 5y$ of a linear programming problem subject to constraints $5x + 10y \leq 50$, $x + y \geq 1$, $y \leq 4$ and $x \geq 0, y \geq 0$ is 3λ. Then the value of λ is

(A) 3. (B) 6.

(C) 9. (D) 27.

148. In a multiple-choice examination, there are 10 questions with one correct option out of 4 options for each question. A student gets 4 marks for each correct answer and 1 mark is deducted for each incorrect answer. The probability that a student, guessing randomly on every question, scores 30 marks in this exam is...

(A) $\frac{45}{4^{10}}$ (B) $\frac{135}{4^{10}}$

(C) $\frac{405}{4^{10}}$ (D) $\frac{810}{4^{10}}$

149. It is known that a box of 8 batteries contains 3 defective pieces and a person randomly selects 2 batteries from this box. Then the probability distribution of the number of defective batteries is

(A)

$X = x$	0	1	2
$P(X = x)$	$\frac{10}{28}$	$\frac{15}{28}$	$\frac{3}{28}$

(B)

$X = x$	1	2	3
$P(X = x)$	$\frac{10}{28}$	$\frac{15}{28}$	$\frac{3}{28}$

(C)

$X = x$	0	1	2
$P(X = x)$	$\frac{15}{28}$	$\frac{10}{28}$	$\frac{3}{28}$

(D)

$X = x$	1	2	3
$P(X = x)$	$\frac{15}{28}$	$\frac{10}{28}$	$\frac{3}{28}$

150. A certain disease has a prevalence of 1% in the population. A diagnostic test for the disease has a sensitivity of 98% and a specificity of 95%. If a person from this population tests positive, then the probability that they actually have the disease is...

(A) 98%
(B) 95%
(C) 16.5%
(D) 1%

- End of Question Paper -