MHT CET 2024 PCM May 9 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 2024**, 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. A stationary wave is formed having 3 nodes along the length of the string 90 cm . The wavelength of the wave is

(A) 60 cm (B) 75 cm
(C) 90 cm (D) 30 cm

2. The spectral series observed for hydrogen atom found in visible region is

(A) Lyman (B) Balmer
(C) Paschen (D) Brackett

3. Three liquids of densities ρ_1, ρ_2 and ρ_3 (with $\rho_1 > \rho_2 > \rho_3$) having same value of surface tension T , rise to the same height in three identical capillaries. Angle of contact θ_1, θ_2 and θ_3 respectively obey

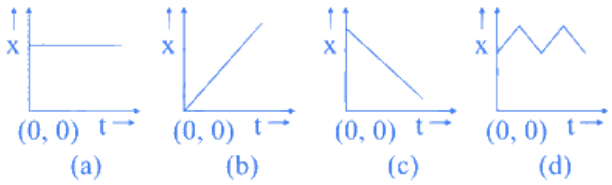
(A) $\frac{\pi}{2} > \theta_1 > \theta_2 > \theta_3 > 0$

(B) $0 \leq \theta_1 < \theta_2 < \theta_3 < \frac{\pi}{2}$

(C) $\frac{\pi}{2} < \theta_1 < \theta_2 < \theta_3 < \pi$

(D) $\pi > \theta_1 > \theta_2 > \frac{\pi}{2}$

4. The following figures show the variation of displacement with time of a particular object.



(A) Figure (a) and (b) show object at rest and object moving with uniform velocity in positive x direction respectively.

(B) Figure (b) and (c) show object at rest and object moving with uniform velocity in negative x direction respectively.

(C) Figure (c) and (d) show object at rest and object moving with uniform velocity in negative x direction respectively.

(D) Figure (a) and (b) show object at rest.

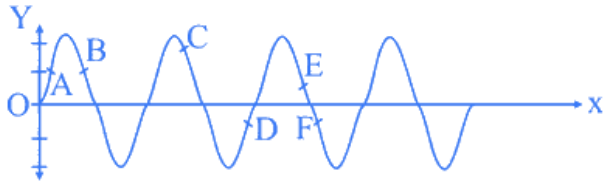
5. A particle of mass ' m ' is rotating in a circular path of radius ' r '. Its angular momentum is ' L ' The centripetal force acting on it is ' F '. The relation between ' F ', ' L ', ' r ' and ' m ' is

(A) $F = \frac{L}{mr^2}$ (B) $L = m^2Fr^2$
(C) $\frac{L^2}{m} = Fr^3$ (D) $\frac{F}{L^3} = mr^2$

6. Two identical galvanometers are converted into voltmeter and millivoltmeter. As compared to the series resistance of voltmeter, the series resistance of millivoltmeter will be

(A) equal (B) more
(C) less (D) zero

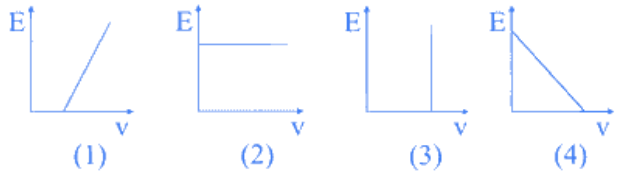
7. The diagram shows the propagation of a progressive wave. A, B, C, D, E are five points on this wave



Which of the following points are in the same state of vibration?

(A) A, B (B) B, C
(C) B, D (D) E, B

8. Using Einstein's photoelectric equation, the graph between kinetic energy of emitted photoelectrons and the frequency of incident radiation is shown correctly by graph



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

9. A string of mass 0.2 Kg is under a tension of 2.5 N . The length of the string is 2 m. A transverse wave starts from one end of the string. The time taken by the wave to reach the other end is

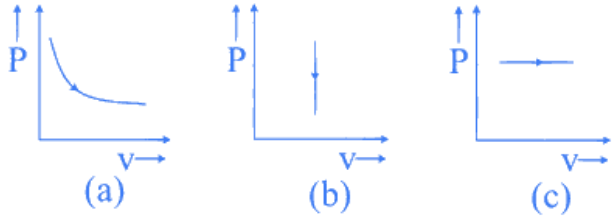
(A) 0.2 s (B) 0.4 s
(C) 0.6 s (D) 0.8 s

10. In the Young's double slit experiment, the intensity at a point on the screen, where the path difference is $\lambda(\lambda =$ wavelength $)$ is β. The intensity at a point where the path difference is $\lambda/3$, will be $\cos\frac{\pi}{3} = 1/2]$

(A) β (B) $\beta/2$

(C) $\frac{\beta}{4}$ (D) $\beta/8$

11. The P-V diagrams for particular gas of different thermodynamic processes are given by



(A) Figure (a) and (b) show isobaric curve and isothermal curve respectively.

(B) Figure (a) and (c) show isothermal curve and isochoric curve respectively.

(C) Figure (b) and (c) show isobaric curve and isochoric curve respectively.

(D) Figure (a) and (c) show isothermal curve and isobaric curve respectively.

12. A musical instrument ' P ' produces sound waves of frequency ' n ' and amplitude ' A '. Another musical instrument ' Q ' produces sound waves of frequency $\frac{n}{4}$. The waves produced by ' P ' and ' Q ' have equal energies. If the amplitude of waves produced by ' P ' is ' A_P ', the amplitude of waves produced by ' Q ' will be

(A) $2\ A_P$ (B) $4\ A_P$

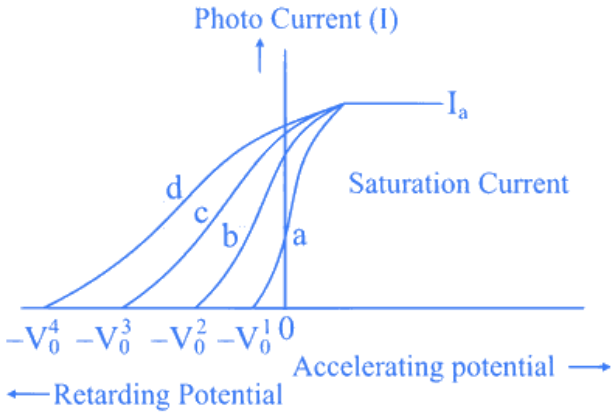
(C) $6\ A_p$ (D) $9\ A_P$

13. Concave and convex lenses are placed touching each other. The ratio of magnitudes of their power is 2 : 3. The focal length of the system is 30 cm . The focal lengths of individual lens are

(A) 5 cm, -10 cm (B) 10 cm, -15 cm

(C) 10 cm, -20 cm (D) 20 cm, -30 cm

14. The figure shows the variation of photocurrent with anode potential for four different radiations. Let f_a, f_b, f_c and f_d be the frequencies for the curves a, b, c and d respectively



(A) $f_a > f_b > f_c > f_d$ (B) $f_a < f_b < f_c < f_d$

(C) $f_a > f_b < f_c = f_d$ (D) $f_a = f_b > f_c > f_d$

15. A disc at rest is subjected to a uniform angular acceleration about its axis. Let θ and θ_1 be the angle made by the disc in 2^{nd} and 3^{rd} second of its motion. The ratio $\frac{\theta}{\theta_1}$ is

(A) 2 : 3 (B) 1 : 2

(C) 2 : 3 (D) 4 : 5

16. Let ' n ' is the number of liquid drops, each with surface energy ' E '. These drops join to form single drop. In this process

(A) some energy will be absorbed

(B) energy absorbed is $[E(n - n^{2/3})]$

(C) energy released will be $[E(n - n^{2/3})]$

(D) energy released will be $[E(2^{2/3} - 1)]$

17. The van de Graaff Generator is not based on

(A) the phenomenon of Corona Discharge in X-ray tube.

(B) the application of electric field and magnetic field which are perpendicular to each other.

(C) the property that charge given to a hollow conductor is transferred to its outer surface and distributed uniformly over it.

(D) the fact that a charge is continuously supplied to an isolated metallic conductor, the potential of the conductor goes on increasing.

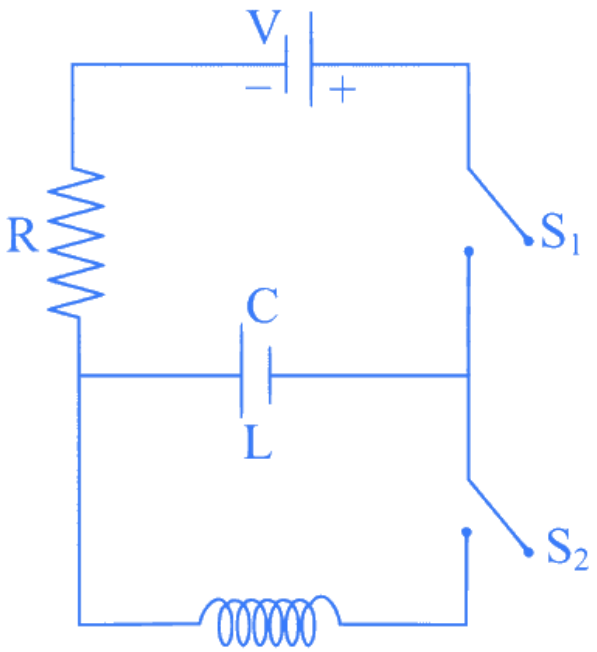
18. Two coils of self-inductance 25 mH and 9 mH are placed close together such that the effective flux in one coil is completely linked with the other The mutual inductance between these coils is

(A) 34 mH (B) 16 mH
(C) 15 mH (D) 6 mH

19. The electric flux over a sphere of radius ' r ' is ' ϕ '. If the radius of the sphere is doubled without changing the charge, the flux will be

(A) 4ϱ (B) 2ϱ
(C) ϱ (D) $\frac{\varrho}{2}$

20. Consider the following circuit. By keeping S_1 closed, the capacitor is fully charged and then S_1 is opened and S_2 is closed, then



(A) At time t = 0, the energy stored in the circuit is purely in the form of magnetic energy.
(B) At t > 0, there is no exchange of energy between L and C.
(C) At any time t > 0, the current in the circuit is in the same direction.
(D) At any time t > 0, the instantaneous current in the circuit may be $V\sqrt{\frac{C}{L}}$

21. In the working of photodiode, the reverse current depends on

(A) concentration of majority carriers.
(B) concentration of minority carriers.
(C) applied voltage.
(D) recombination of holes and electrons.

22. A satellite is revolving around a planet in a circular orbit close to its surface. Let ' ρ ' be the mean density and ' R ' be the radius of the planet. Then the period of the satellite is (G = universal constant of gravitation)

(A) $\sqrt{\frac{4\pi}{\rho G}}$ (B) $\sqrt{\frac{\pi}{\rho G}}$
(C) $\sqrt{\frac{3\pi}{\rho G}}$ (D) $\sqrt{\frac{2\pi}{\rho G}}$

23. A current carrying circular loop of radius ' R ' and current carrying long straight wire are placed in the same plane. I_c and I_w are the currents through circular loop and long straight wire respectively. The perpendicular distance between centre of the circular loop and wire is ' d '. The magnetic field at the centre of the loop will be zero when separation ' d ' is equal to

(A) $\frac{RI_w}{\pi I_c}$ (B) $\frac{RI_c}{\pi I_w}$
(C) $\frac{\pi I_c}{RI_w}$ (D) $\frac{\pi I_w}{R_c}$

24. A square loop ABCD is moving with constant velocity ' $\vec{v}$ ' in a uniform magnetic field ' $\vec{B}$ ' which is perpendicular to the plane of paper and directed outward. The resistance of coil is ' R ', then the rate of production of heat energy in the loop is [L - length of side of loop]

(A) $\frac{B^2L^2V}{R}$ (B) $\frac{B^2L^2V^2}{R}$
(C) $\frac{B^2LV^2}{R}$ (D) $\frac{BLV^2}{R}$

25. The fringe width in an interference pattern is ' X '. The distance between the sixth dark fringe from one side of central bright band to the fourth bright fringe on other side is

(A) 1.5 X (B) 2 X
(C) 5.5 X (D) 9.5 X

26. A particle is executing a linear simple harmonic motion. Let ' V_1 ' and ' V_2 ' are its speed at distance ' x_1 ' and ' x_2 ' from the equilibrium position. The amplitude of oscillation is

(A) $\sqrt{\frac{V_1^2x_2^2-V_2^2x_2^2}{V_1^2-V_2^2}}$ (B) $\sqrt{\frac{V_1^2-V_2^2}{V_1^2x_2^2-V_2^2x_1^2}}$
(C) $\sqrt{\frac{V_1^2x_2^2-V_2^2x_1^2}{V_1^2-V_2^2}}$ (D) $\sqrt{\frac{V_1^2x_1^2-V_2^2x_2^2}{V_1^2-V_2^2}}$

27. In hydrogen atom, if V_n and V_p are orbital velocities in n^{th} and p^{th} orbit respectively, then the ratio $V_p : V_n$ is

(A) $p : n$ (B) $n : p$

(C) $p^2 : n^2$ (D) $n^2 : p^2$

28. The work done in splitting a water drop of radius R into 64 droplets is (T = Surface tension of water)

(A) $6\pi TR^2$ (B) $12\pi TR^2$

(C) $8\pi TR^2$ (D) $24\pi TR^2$

29. The potential difference that must be applied across the series and parallel combination of 4 identical capacitors is such that the energy stored in them becomes the same. The ratio of potential difference in series to parallel combination is

(A) 1 : 2 (B) 1 : 4

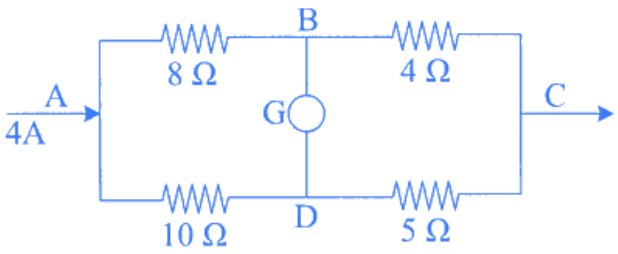
(C) 4 : 1 (D) 2 : 1

30. A metal rod of weight ' W ' is supported by two parallel knife-edges A and B . The rod is in equilibrium in horizontal position. The distance ' between two knife-edges is ' r '. The centre of mass of the rod is at a distance ' x ' from A. The normal reaction on A is

(A) $\frac{W \cdot r}{x}$ (B) $\frac{W \cdot x}{r}$

(C) $\frac{W \cdot (r-x)}{x}$ (D) $\frac{W \cdot (r-x)}{r}$

31. Potential difference between the points A and B is nearly



(A) 10 V (B) 14 V

(C) 18 V (D) 20 V

32. An ideal gas ($\gamma = 1.5$) is expanded adiabatically. To reduce root mean square velocity of molecules two times, the gas should be expanded

(A) 20 times (B) 16 times

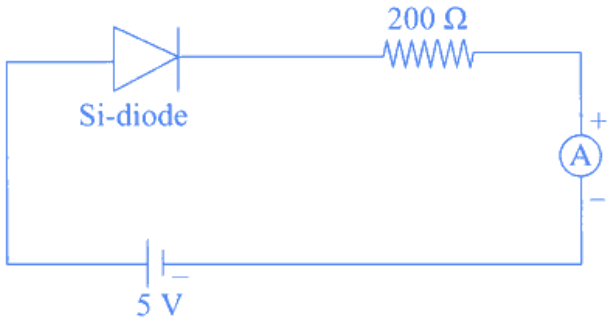
(C) 12 times (D) 8 times

33. An e.m.f. $E = E_0 \cos \omega t$ is applied to circuit containing L and R in series. If $X_L = 2R$, then the power dissipated in the circuit is

(A) $\frac{E_0^2}{12R}$ (B) $\frac{E_0^2}{10R}$

(C) $\frac{E_0^2}{8R}$ (D) $\frac{E_0^2}{6R}$

34. In the following circuit, the reading in the ammeter is



(A) 25.1 mA (B) 22.5 mA

(C) 21.5 mA (D) 21.25 mA

35. A black body radiates power ' P ' and maximum energy is radiated by it at a wavelength λ_0. The temperature of the black body is now so changed that it radiates maximum energy at the wavelength $\frac{\lambda_0}{4}$. The power radiated by it at new temperature is

(A) 64 P (B) 256 P

(C) 4 P (D) 16 P

36. In Young's double slit experiment using monochromatic light of wavelength ' λ ', the maximum intensity of light at a point on the screen is ' K ' units. The intensity of light at a point where the path difference is $\frac{\lambda}{6}$ ' is

($\cos 60^\circ = \sin 30^\circ = 0.5, \sin 60^\circ = \cos 30^\circ = \sqrt{3}/2$)

(A) $\frac{3K}{4}$ (B) $\frac{K}{4}$

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

37. When a capacitor is connected in series LR circuit, the alternating current flowing in the circuit

(A) is zero. (B) remains constant.

(C) increases. (D) decreases.

38. The correct relation between total magnetic field (B), magnetic intensity (H), permeability of free space (μ_0) and susceptibility (χ) is

(A) $\frac{B}{H} = \mu_0(1-\chi)$ (B) $\frac{\mathrm{B}}{\mathrm{H}} = \mu_0(1+\chi)^2$

(C) $\frac{\mathrm{B}}{\mathrm{H}} = \mu_0(1+\chi)$ (D) $\frac{\mathrm{B}}{\mathrm{H}} = \mu_0(1-\chi)^2$

39. The resultant gate and its Boolean expression in the given circuit is



(A) OR, $\mathrm{A}+\mathrm{B}$ (B) AND, $\mathrm{A}\cdot\mathrm{B}$

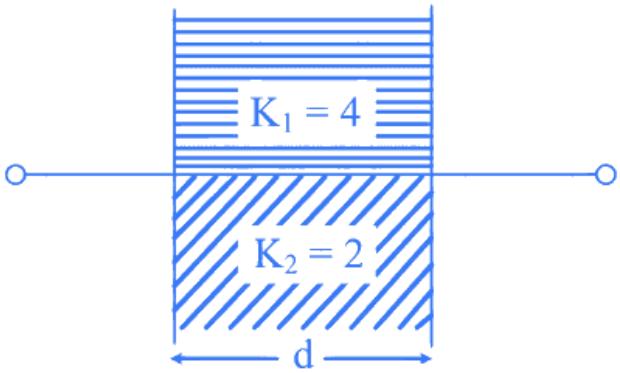
(C) NOR, $\mathrm{A}+\mathrm{B}$ (D) NAND, $\mathrm{A}\overline{+}\mathrm{B}$

40. The temperature of a liquid falls from 365 K to 359 K in 3 minutes. The time during which temperature of this liquid falls from 342 K to 338 K is [Let the room temperature be 296 K]

(A) 6 min (B) 4 min

(C) 3 min (D) 2 min

41. Air capacitor has capacitance of 1μ F. Now the space between two plates of capacitor is filled with two dielectrics as shown in figure. The capacitance of the capacitor is [d = distance between two plates of capacitor, K_1 and K_2 are dielectric constants of first dielectric and second dielectric respectively]



(A) 3μ F (B) 6μ F

(C) 8μ F (D) 12μ F

42. In an isobaric process of an ideal gas, the ratio of work done by the system (W) during the expansion and the heat exchanged (Q) is $\left(\gamma = \frac{\mathrm{C_p}}{\mathrm{C_v}}\right)$

(A) γ (B) $\gamma - 1$

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

43. A long solenoid carrying a current produces magnetic field B along its axis. If the number of turns per cm are tripled and the current is made $\left(\frac{1}{4}\right)^{\text{th}}$ then the new value of magnetic field will be

(A) $\frac{B}{3}$ (B) $\frac{\mathrm{B}}{4}$

(C) $\frac{3B}{4}$ (D) $\frac{2\,\mathrm{B}}{3}$

44. An astronomical telescope has a large aperture to

(A) have high resolution. (B) have low dispersion.

(C) increase the span of observation. (D) have large wavelength.

45. A sonometer wire is in unison with a tuning fork of frequency ' n ' when it is stretched by a weight of specific gravity ' d '. When the weight is completely immersed in water, ' x ' beats are produced per second, then

(A) $\frac{\mathrm{n}}{\mathrm{n-x}} = \frac{\mathrm{d}}{\mathrm{d-1}}$ (B) $\frac{n}{n-x} = \sqrt{\frac{d}{d-1}}$

(C) $\frac{\mathrm{n-x}}{\mathrm{n}} = \frac{\mathrm{d-1}}{\mathrm{d}}$ (D) $\frac{\mathrm{n-x}}{\mathrm{n}} = \sqrt{\frac{\mathrm{d}}{\mathrm{d-1}}}$

46. The radius of the planet is double that of the earth, but their average densities are same. $\mathrm{V_p}$ and V_E are the escape velocities of planet and earth respectively. If $\frac{V_P}{V_E} = x$, the value of ' x ' is

(A) $\frac{1}{4}$ (B) $\frac{1}{2}$

(C) 2 (D) 4

47. Three thin rods, each mass ' 2 M ' and length ' L ' are placed along x, y and z axis which are mutually perpendicular. One end of each rod is at origin. Moment of inertia of the system about x - axis is

(A) $\frac{4\mathrm{ML}^2}{3}$ (B) $\frac{\mathrm{ML}^2}{12}$

(C) $\frac{\mathrm{ML}^2}{6}$ (D) $\frac{2\mathrm{ML}^2}{3}$

48. The magnetic potential energy stored in certain inductor is 64×10^{-3} J, when the current in the inductor is 80 mA . This inductor is of inductance

(A) 0.20 H (B) 2.0 H

(C) 20 H (D) 200 H

49. Two identical drops of water are falling through air with steady velocity ' V '. If the two drops come together to form a single drop. The new velocity of the single drop is

(A) $(2)^{1/3}$ V (B) $(2)^{3/2}$ V

(C) $(2)^{2/3}$ V (D) $(2)^{1/4}$ V

50. The equations of two waves are given as

$$y_1 = a\sin\left(\omega t + \phi_1\right)$$

$$y_2 = a\sin\left(\omega t + \phi_2\right)$$

If amplitude and time period of resultant wave is same as the individual waves, then $(\phi_1 - \phi_2)$ is

(A) $\cos^{-1}\left(\frac{-1}{2}\right)$ (B) $\cos^{-1}\left(\frac{-1}{4}\right)$

(C) $\cos^{-1}\left(-\frac{1}{6}\right)$ (D) $\cos^{-1}\left(-\frac{1}{8}\right)$

51. Calculate the molar mass of an element having density $5.6\ \text{g cm}^{-3}$ that forms bcc structure $\left[a^3 \times N_A = 75\ \text{cm}^3\ \text{mol}^{-1}\right]$

(A) $198\ \text{g mol}^{-1}$ (B) $210\ \text{g mol}^{-1}$

(C) $118\ \text{g mol}^{-1}$ (D) $225\ \text{g mol}^{-1}$

52. Identify the products obtained in the ozonolysis of propene.

(A) Methanol and Ethanol (B) Methanal and Ethanol

(C) Methanal and Ethanal (D) Methanol and Ethanal

53. Identify the hybridisation and geometry of SF_4 molecule respectively.

(A) sp^3d and Trigonal bipyramidal (B) sp^3 and trigonal bipyramidal

(C) $sp^3\ d^2$ and trigonal bipyramidal (D) $sp^3\ d^2$ and octahedral

54. Which from following buffers is used to maintain the pH of human blood naturally?

(A) Hydrogen cyanide and sodium cyanide (B) Copper hydroxide and copper chloride

(C) Carbonic acid and salt of carbonic acid (D) Ammonium hydroxide and ammonium chloride

55. Identify the carbon atoms of glucose and of fructose forming glycosidic bond in sucrose.

(A) C -1 of α-glucose and C $-$ 2 of β-fructose (B) C -1 of β-glucose and C -2 of β-fructose

(C) C -2 of α-glucose and C -2 of β-fructose (D) C-3 of α-glucose and $C-1$ of β-fructose

56. Resistance and conductivity of a cell containing 0.1 M KCl solution at 298 K are 115 ohm and $1.90 \times 10^{-6}\ \text{S cm}^{-1}$ respectively. What is the value of cell constant?

(A) $0.165\ \text{cm}^{-1}$ (B) $1.601\ \text{cm}^{-1}$

(C) $2.185\ \text{cm}^{-1}$ (D) $0.218\ \text{cm}^{-1}$

57. 10 g each of NH_3, N_2, Cl_2 and H_2S are expanded isothermally and reversibly at same temperature. Identify gas that performs maximum work.

(A) N_2 (B) Cl_2

(C) H_2S (D) NH_3

58. A solution of non volatile solute has boiling point elevation 0.5 K . Calculate molality of solution $\left[K_b = 2.40\ \text{K kg mol}^{-1}\right]$.

(A) $0.12\ \text{mol kg}^{-1}$ (B) $0.16\ \text{mol kg}^{-1}$

(C) $0.21\ \text{mol kg}^{-1}$ (D) 0.28 mol kg

59. Chlorine has two isotopes ^{35}Cl and ^{37}Cl with average atomic mass of 35.5 . What is the ratio of their relative abundance respectively?

(A) 1 : 1 (B) 2 : 1

(C) 1 : 3 (D) 3 : 1

60. Which among the following is NOT a true statement regarding enantiomers?

(A) Enantiomers have identical refractive index. (B) Enantiomers have same chemical properties.

(C) Enantiomers are superimposable mirror images of each other. (D) Enantiomers have equal but opposite optical rotation.

61. Which from following polymers is believed to leach human carcinogen in to food when used as household plastic?

(A) LDPE (B) PP

(C) PS (D) PET

62. Which from following molecules has trigonal planar geometry?

(A) CH_4 (B) C_2H_2

(C) NH_3 (D) BF_3

63. Which from following polymers is grouped under elastomers?

(A) Buna-S (B) Nylon 6,6

(C) Terylene (D) Polythene

64. What type of following compounds is obtained in first step of Wolf-Kishner reduction of carbonyl compounds?

(A) Carboxylic Acids (B) Alcohols
(C) Hydrazones (D) Alkenes

65. The reaction $2\ A + B + C \longrightarrow D + E$ is found to be first order in A , second order in B and zero order in C . What is the effect of increasing concentration of all reactants twice?

(A) Rate of reaction increases 8 times. (B) Rate of reaction increases 24 times.
(C) Rate of reaction increases 36 times. (D) Rate of reaction remains unaffected.

66. Calculate mass in kg of $4.48 dm^3$ carbon dioxide at STP.

(A) 2.2×10^{-3} (B) 4.4×10^{-3}
(C) 6.6×10^{-3} (D) 8.8×10^{-3}

67. Calculate the molar mass of solute in a solution prepared by dissolving 1 gram in 0.3 dm^3 solvent having osmotic pressure 0.2 atm at 300 K.
$\left[R = 0.082\ dm^3\ atm\ K^{-1}\ mol^{-1}\right]$

(A) 442 g mol^{-1} (B) 372 g mol^{-1}
(C) 390 g mol^{-1} (D) 410 g mol^{-1}

68. Identify the product obtained when chlorobenzene is heated with conc. HNO_3 in presence of conc. H_2SO_4.

(A) Only 1-chloro-4-nitrobenzene
(B) Only 1-chloro-2-nitrobenzene
(C) Mixture of 1-chloro-4-nitrobenzene and 1-chloro-2-nitrobenzene
(D) 2,4,6-trinitrochlorobenzene

69. Which from following is a correct priority order for selection of principal functional group for nomenclature of polyfunctional compound?

(A) $-COOH > -SO_3H > -COOR$
(B) $-COOR > -COOH > -SO_3H$
(C) $-SO_3H > -COOR > -COOH$
(D) $-COOR > -SO_3H > -COOH$

70. Which of the following is used to avoid leakage of electrolyte in dry cell?

(A) Paste of MnO_2 (B) Paste of NH_4Cl
(C) Starch (D) Paste of $ZnCl_2$

71. Identify the polymer used to obtain LCD screen from following.

(A) Polyacrylamide (B) Buna-N
(C) Polycarbonate (D) Perspex

72. Identify the product X in the following reaction.
Sodium propanoate $\xrightarrow[\Delta]{\text{soda-lime}} X +$ sodium carbonate

(A) Propane (B) Ethane
(C) Methane (D) Butane

73. Which of the following changes involves transfer of 5 electrons?

(A) $MnO_4^- \longrightarrow Mn^{2+}$ (B) $CrO_4^{2-} \longrightarrow Cr^{3+}$
(C) $NO_3^- \longrightarrow NH_4^+$ (D) $Cr_2O_7^{2-} \longrightarrow 2Cr^{3+}$

74. Identify order of following reaction.
$$H_2O_{2(g)} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$$

(A) 0 (B) 1
(C) 1.5 (D) 2

75. Assuming complete ionisation, arrange the following solutions in order of increasing osmotic pressure.
a) 0.5 m Li_2SO_4
b) 0.5 m KCl
c) 0.5 m $Al_2(SO_4)_3$
d) 0.1 m $BaCl_2$

(A) d < b < a < c (B) b < d < c < a
(C) a < d < c < b (D) c < d < b < a

76. Which isomer of C_4H_9OH has lower boiling point?

(A) n-Butyl alcohol (B) Isobutyl alcohol
(C) Sec-Butyl alcohol (D) tert-Butyl alcohol

77. Which element from following in +2 state exhibits highest magnetic moment?

(A) Fe (B) Cr
(C) Mn (D) Ni

78. Which from following anions has maximum coagulating power for precipitation of positive sol?

(A) $[Fe(CN)_6]^{4-}$ (B) Cl^-
(C) SO_4^{2-} (D) PO_4^{3-}

79. What is the oxidation state of central metal ion in $[Fe(CN)_6]^{4-}$ complex?

(A) $+2$ (B) -6

(C) -4 (D) $+3$

80. Which one of the following compounds does not react with acetyl chloride?

(A) $CH_3CH_2NH_2$

(B) $CH_3CH_2CH_2NHCH_3$

(C) $(CH_3CH_2)_3N$

(D) $(CH_3)_3CNH_2$

81. For the reaction, $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$ NH_3 is formed at a rate of $0.088\ mol\ dm^{-3}\ s^{-1}$. Calculate consumption rate of $N_{2(g)}$.

(A) $0.011\ mol\ dm^{-3}\ s^{-1}$ (B) $0.022\ mol\ dm^{-3}\ s^{-1}$

(C) $0.033\ mol\ dm^{-3}\ s^{-1}$ (D) $0.044\ mol\ dm^{-3}\ s^{-1}$

82. What is the coordination number of a particle in fcc structure?

(A) 12 (B) 2

(C) 4 (D) 6

83. Which of the following elements does not react with water to form metal hydroxide?

(A) Mg (B) Ca

(C) Be (D) Sr

84. Identify the major product formed when 2-Methylhexan-3-ol is heated with concentrated sulphuric acid.

(A) 

(B) 

(C) 

(D) 

85. What is the highest oxidation state of third row transition elements?

(A) $+5$ (B) $+6$

(C) $+7$ (D) $+8$

86. Calculate the solubility of sparingly soluble salt BA in $moldm^{-3}$ at 300 K if its solubility product is 4.9×10^{-9} at same temperature.

(A) 5.72×10^{-5} (B) 6.40×10^{-5}

(C) 7.00×10^{-5} (D) 7.81×10^{-5}

87. Which of the following amines undergoes acylation reaction?

(A) Ethyldimethylamine

(B) N -Methylaniline

(C) N, N-Dimethylmethanamine

(D) N, N-Dimethylaniline

88. Which from following is a formula of sodium hexafluoroaluminate(III)?

(A) $Na_3[AlF_6]$ (B) $Na[AlF_6]$

(C) $Na_2[AlF_6]^{2+}$ (D) $[Al(NaF)_6]^{2+}$

89. Identify the factor from following on which heat of reaction does not depend.

(A) Physical states of reactants and products.

(B) Total number of steps in which reaction occurs.

(C) Temperature of the reaction.

(D) Whether the reaction is carried out at constant pressure or constant volume.

90. What type of following forces is present ethylene glycol?

(A) Dipole-induced dipole

(B) Dipole-dipole

(C) Dispersion forces

(D) Intramolecular hydrogen bonding

91. Calculate the volume of fcc unit cell if radius of a particle in it is 106.05 pm.

(A) $7.4 \times 10^{-23}\ cm^3$ (B) $9.9 \times 10^{-23}\ cm^3$

(C) $2.7 \times 10^{-23}\ cm^3$ (D) $6.4 \times 10^{-23}\ cm^3$

92. Identify product ' B ' in the following reaction.

Cumene $\xrightarrow[\Delta]{KMnO_4, KOH}$ A $\xrightarrow{H_3O^+}$ B

(A) Phenol (B) Benzaldehyde

(C) Benzophenone (D) Benzoic acid

93. What is the name of isobutyl alcohol according to carbinol system?

(A) Ethyl methyl carbinol

(B) Isobutyl carbinol

(C) Isopropyl carbinol

(D) Diethyl carbinol

94. Which from following elements has highest value of ionization enthalpy ($\Delta_I H_1$) ?

(A) He (B) Ar

(C) Cl (D) I

95. Calculate the pH of buffer solution containing 0.04 M NaF and 0.02 M HF $[pK_a = 3 \cdot 142]$.

(A) 4.5 (B) 3.4

(C) 2.6 (D) 5.1

96. Which from following is NOT a globular protein?

(A) Myosin (B) Insulin

(C) Egg albumin (D) Legumelin

97. What is the quantity of electricity required to produce 4.8 g of Mg (molar mass $= 24\ g\ mol^{-1}$) from its salt solution?

(A) 10 F (B) 4 F

(C) 1 F (D) 0.4 F

98. Which parameter is indicated by the number of waves passing through a given point in one second?

(A) Wavelength (B) Frequency

(C) Wave number (D) Amplitude

99. For the reaction,
$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(g)}, \Delta H^\circ = -573.2\ kJ$
What is heat of decomposition of water per mol?

(A) $-28.66\ kJ$ (B) $143.3\ kJ$

(C) $286.6\ kJ$ (D) $573.2\ kJ$

100. Which is the most commonly used refrigerant Freon-12?

(A) Monochloromonofluoromethane

(B) Dichlorodifluoromethane

(C) Chlorodifluoromethane

(D) Dichlorofluoromethane

101. The maximum value of $z = 4x + 2y$, subject to the constraints $3x + 4y \geqslant 12, x + y \leqslant 5, x, y \geqslant 0$ is

(A) 8 (B) 20

(C) 24 (D) 16

102. The value of $\int \frac{x+1}{x(1+xe^x)^2}dx$ is equal to

(A) $\log(\frac{xe^x}{1+xe^x}) + \frac{x}{1+xe^x} + c$, where c is a constant of integration

(B) $\log(\frac{xe^x}{1+xe^x}) + \frac{e^x}{1+xe^x} + c$, where c is a constant of integration

(C) $\log(\frac{xe^x}{1+xe^x}) + \frac{1}{1+xe^x} + c$, where c is a constant of integration

(D) $\log(\frac{xe^x}{1+xe^x}) - \frac{x}{1+xe^x} + c$, where c is a constant of integration

103. If $p \to (\sim p \vee \sim q)$ is false, then the truth values of p and q are respectively

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

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

104. Let α, β be the roots of the equation $x^2 - px + r = 0$ and $\frac{\alpha}{2}, 2\beta$ be the roots of the equation $x^2 - qx + r = 0$. Then the value of r is

(A) $\frac{2}{9}(p - q)(2q - p)$ (B) $\frac{2}{9}(q - p)(2p - q)$

(C) $\frac{2}{9}(q - 2p)(2q - p)$ (D) $\frac{2}{9}(2p - q)(2q - p)$

105. Let $\overline{a} = \alpha\hat{i} + 3\hat{j} - \hat{k}$, $\overline{b} = 3\hat{i} - \beta\hat{j} + 4\hat{k}$ and $\overline{c} = \hat{i} + 2\hat{j} - 2\hat{k}$, where $\alpha, \beta \in \mathbb{R}$, be three vectors. If the projection at $\overline{a}$ on $\overline{c}$ is $\frac{10}{3}$ and $\overline{b} \times \overline{c} = -6\hat{i} + 10\hat{j} + 7\hat{k}$, then the value of $\alpha^2 + \beta^2 - \alpha\beta$ is equal to

(A) 1 (B) 2

(C) 3 (D) 4

106. The function $f(x) = 2x^3 - 6x + 5$ is an increasing function, if

(A) $0 < x < 1$ (B) $-1 < x < 1$

(C) $x < -1$ or $x > 1$ (D) $-1 < x < -\frac{1}{2}$

107. Let $2\sin^2 x + 3\sin x - 2 > 0$ and $x^2 - x - 2 < 0$ (x is measured in radians). Then x lies in the interval

(A) $(\frac{\pi}{6}, \frac{5\pi}{6})$ (B) $(-1, \frac{5\pi}{6})$

(C) $(-1, 2)$ (D) $(\frac{\pi}{6}, 2)$

108. Let $\overline{a}, \overline{b}$ and $\overline{c}$ be vectors of magnitude 2,3 and 4 respectively. If $\bar{a}$ is perpendicular to $(\bar{b} + \bar{c})$, $\bar{b}$ is perpendicular to $(\bar{c} + \bar{a})$ and $\bar{c}$ is perpendicular to $(\bar{a} + \bar{b})$, then the magnitude of $\overline{a} + \overline{b} + \overline{c}$ is equal to

(A) 29 (B) $\sqrt{29}$

(C) 26 (D) $\sqrt{26}$

109. A square plate is contracting at the uniform rate 3 cm^2/sec, then the rate at which the perimeter is decreasing, when the side of the square is 15 cm , is

(A) $\frac{1}{5}$ cm/sec (B) $\frac{2}{5}$ cm/sec

(C) $\frac{1}{10}$ cm/sec (D) $\frac{3}{10}$ cm/sec

110. The area (in sq. units), in the first quadrant bounded by the curve $y = x^2 + 2$ and the lines $y = x + 1, x = 0$ and $x = 2$, is

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

(C) $\frac{5}{3}$ (D) $\frac{8}{3}$

111. The vector $\bar{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}$ lies in the plane of the vectors $\overline{b} = \hat{i} + \hat{j}$ and $\overline{c} = \hat{j} + \hat{k}$ and bisects the angle between $\overline{b}$ and $\overline{c}$. Then which one of the following gives possible values of α and β ?

(A) $\alpha = 1, \beta = 1$ (B) $\alpha = 2, \beta = 2$

(C) $\alpha = 1, \beta = 2$ (D) $\alpha = 2, \beta = 1$

112. $2\pi - \left(\sin^{-1}\frac{4}{5} + \sin^{-1}\frac{5}{13} + \sin^{-1}\frac{16}{65}\right)$ is equal to

(A) $\frac{\pi}{2}$ (B) $\frac{5\pi}{4}$

(C) $\frac{7\pi}{4}$ (D) $\frac{3\pi}{2}$

113. For the matrix $A = \begin{bmatrix} 2 & 0 & -1 \\ 3 & 1 & 2 \\ -1 & 1 & 2 \end{bmatrix}$, the matrix of cofactors is

(A) $\begin{bmatrix} 0 & 8 & -4 \\ -1 & 3 & 2 \\ 1 & -7 & 2 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & -8 & 4 \\ -1 & 3 & -2 \\ 1 & -7 & 2 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 8 & -4 \\ 1 & -3 & 2 \\ -1 & 7 & -2 \end{bmatrix}$ (D) $\begin{bmatrix} 0 & -8 & 4 \\ -1 & 3 & 2 \\ -1 & -7 & 2 \end{bmatrix}$

114. If $y = \sin^{-1}\left(\frac{3x}{2} - \frac{x^3}{2}\right)$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{3}{2\sqrt{x^2-4}}$ (B) $\frac{3}{\sqrt{4-x^2}}$

(C) $\frac{3}{2\sqrt{1-x^2}}$ (D) $\frac{4}{\sqrt{4-x^2}}$

115. A unit vector coplanar with $\hat{i}+\hat{j}+\hat{k}$ and $2\hat{i}+\hat{j}+\hat{k}$ and perpendicular to $\hat{i}+\hat{j}-\hat{k}$ is

(A) $+\frac{1}{\sqrt{2}}(-\hat{j}-\hat{k})$ (B) $\frac{(\hat{j}-\hat{k})}{\sqrt{2}}$

(C) $\frac{-\hat{j}+2\hat{k}}{\sqrt{5}}$ (D) $+\frac{1}{\sqrt{26}}(\hat{j}+5\hat{k})$

116. Negation of the statement ' Horses have wings if and only if crows have tails. ' is

(A) Horses have wings but crows do not have tails. or crows have tails but horses do not have wings.

(B) Horses do not have wings if and only if crows do not have tails.

(C) Horses do not have wings and crows have tails. or Horses have wings and crows have tails.

(D) Horses do not have wings and crows do not have tails.

117. A plane which is perpendicular to two planes $2x-2y+z=0$ and $x-y+2z=4$, passes through $(1,2,1)$. The distance of the plane from the point $(2,3,4)$ is

(A) $\sqrt{\frac{2}{5}}$ units (B) $\frac{2\sqrt{2}}{5}$ units

(C) $\frac{2}{\sqrt{5}}$ units (D) $\frac{1}{\sqrt{5}}$ units

118. If $\log(x+y) = \sin(x+y)$, then $\frac{dy}{dx}$ is

(A) 2 (B) 1

(C) 0 (D) -1

119.

$$\int \sqrt{e^x - 1}\ dx =$$

(A) $\sqrt{e^x-1} + \tan^{-1}\sqrt{e^x-1} + c$, (where c is constant of integration)

(B) $2\sqrt{e^x-1} + \tan^{-1}\sqrt{e^x-1} + c$, (where c is constant of integration)

(C) $2\sqrt{e^x-1} - 2\tan^{-1}\sqrt{e^x-1} + c$, (where c is constant of integration)

(D) $2\sqrt{e^x-1} - \tan^{-1}\sqrt{e^x-1} + c$, (where c is constant of integration)

120. The variance of 20 observations is 5 . If each observation is multiplied by 3 and then 8 is added to each number, then variance of resulting observations is

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

(C) $\frac{5}{3}$ (D) $\frac{3}{5}$

121. The value of m such that $\frac{x-4}{1} = \frac{y-2}{1} = \frac{z+m}{2}$ lies in the plane $2x-4y+z=7$ is

(A) 7 (B) -7

(C) no real value (D) 4

122. Four persons can hit a target correctly with probabilities $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ and $\frac{1}{5}$ respectively. If all hit at the target independently, then the probability that the target would be hit, is

(A) $\frac{1}{5}$ (B) $\frac{3}{5}$

(C) $\frac{2}{5}$ (D) $\frac{4}{5}$

123. A poster is to be printed on a rectangular sheet of paper of area 18 m^2. The margins at the top and bottom of 75 cm each and at the sides 50 cm each are to be left. Then the dimensions i.e. height and breadth of the sheet so that the space available for printing is maximum, are _____ respectively.

(A) $2\sqrt{3}$ m, $3\sqrt{3}$ m (B) $3\sqrt{3}$ m, $2\sqrt{3}$ m

(C) 3 m, 6 m (D) 6 m, 3 m

124. The approximate value of $(3.978)^{3/2}$ is

(A) 7.096 (B) 8.096

(C) 7.934 (D) 8.934

125. The number of integral values of k, for which the equation $7\cos x + 5\sin x = 2k+1$ has a solution, is

(A) 4 (B) 8

(C) 10 (D) 2

126. The domain of definition of the function $f(x)$ given by the equation $2^x + 2^y = 2$ is

(A) $0 < x \leq 1$ (B) $0 \leq x \leq 1$

(C) $-\infty < x \leq 0$ (D) $-\infty < x < 1$

127. Let $\bar{a} = 3\hat{i} - \alpha\hat{j} + \hat{k}$ and $\bar{b} = \hat{i} + \alpha\hat{j} + 3\hat{k}$. If the area of the parallelogram whose adjacent sides are represented by the vectors $\bar{a}$ and $\bar{b}$, is $8\sqrt{3}$ sq. units, then $\bar{a} \cdot \bar{b}$ is equal to

(A) 1 (B) 2

(C) 3 (D) 4

128. If A, B, C are the angles of a triangle with $\tan\frac{A}{2}=\frac{1}{3}, \tan\frac{B}{2}=\frac{2}{3}$ then the value of $\tan\frac{C}{2}$ is

(A) $\frac{-7}{9}$ (B) $\frac{7}{9}$

(C) $\frac{9}{7}$ (D) $\frac{-9}{7}$

129. A line with positive direction cosines passes through the point $P(2,1,2)$ and makes equal angles with the coordinate axes. The line meets the plane $2x+y+z=9$ at point Q . The length of the line segment PQ equals units.

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

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

130. The equation of the tangent to the curve $x=a\cos^3\theta, y=a\sin^3\theta$ at $\theta=\frac{\pi}{4}$ is

(A) $x+y=\frac{a}{\sqrt{2}}$ (B) $x+y=\frac{a}{2}$

(C) $x+y=\frac{a}{2\sqrt{2}}$ (D) $x+y=\frac{a}{8}$

131.

$$\lim_{x\to\frac{\pi}{2}}\frac{(1-\sin x)\left(8x^3-\pi^3\right)\cos x}{(\pi-2x)^4}$$

(A) $\frac{\pi^2}{16}$ (B) $\frac{3\pi^2}{16}$

(C) $\frac{-3\pi^2}{16}$ (D) $\frac{-\pi^2}{16}$

132. The integral $\int_{\frac{\pi}{6}}^{\frac{\pi}{4}}\frac{dx}{\sin 2x(\tan^5 x+\cot^5 x)}$ is equal to

(A) $\frac{1}{5}\left(\frac{\pi}{4}-\tan^{-1}\left(\frac{1}{3\sqrt{3}}\right)\right)$ (B) $\frac{1}{10}\left(\frac{\pi}{4}-\tan^{-1}\left(\frac{1}{9\sqrt{3}}\right)\right)$

(C) $\frac{1}{20}\tan^{-1}\left(\frac{1}{9\sqrt{3}}\right)$ (D) $\frac{\pi}{40}$

133. The equation of the circle, concentric with the circle $x^2+y^2-6x-4y-12=0$ and touching the X-axis is

(A) $x^2+y^2-6x-4y+5=0$

(B) $x^2+y^2-6x-4y+17=0$

(C) $x^2+y^2-6x-4y+9=0$

(D) $x^2+y^2-6x-4y+4=0$

134. Let $f(x)=e^x$, $g(x)=\sin^{-1}x$ and $h(x)=f(g(x))$, then $\left(\frac{h'(x)}{h(x)}\right)^2$ is equal to

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

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

135. The joint equation of pair of lines through the origin and making an angle of $\frac{\pi}{6}$ with the line $3x+y-6=0$ is

(A) $13x^2+12xy+3y^2=0$

(B) $13x^2-12xy+3y^2=0$

(C) $13x^2+12xy-3y^2=0$

(D) $13x^2-12xy-3y^2=0$

136. A line $4x+y=1$ passes through the point $A(2,-7)$ meets the line BC whose equation is $3x-4y+1=0$ at the point B. The equation of the line AC so that $AB=AC$ is

(A) $52x+89y+519=0$

(B) $52x+89y-727=0$

(C) $52x-89y+519=0$

(D) $52x-89y-727=0$

137. The value of $\int\frac{dx}{(x+1)^{3/4}(x-2)^{5/4}}$ is equal to

(A) $4\left(\frac{x+1}{x-2}\right)^{1/4}+c$, where c is a constant of integration.

(B) $4\left(\frac{x-2}{x-1}\right)^{1/4}+c$, where c is a constant of integration.

(C) $\frac{-4}{3}\left(\frac{x-2}{x+1}\right)^{1/4}+c$, where c is a constant of integration.

(D) $\frac{-4}{3}\left(\frac{x+1}{x-2}\right)^{1/4}+c$, where c is a constant of integration.

138. The smallest positive value of x in degrees satisfying the equation

$\tan(x+100^\circ)=\tan(x+50^\circ)$

$\tan(x)\tan(x-50^\circ)$

is

(A) 30° (B) 15°

(C) 45° (D) 60°

139. If $\int\frac{\cos x-\sin x}{\sqrt{8-\sin 2x}}dx=a\sin^{-1}\left(\frac{\sin x+\cos x}{b}\right)+c$ Where c is a constant of integration, then the ordered pair (a,b) is equal to

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

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

140. Let L be the line of intersection of the planes $2x+3y+z=1$ and $x+3y+2z=2$. If L makes an angle α with the positive X -axis, then $\cos\alpha$ equals

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

(C) $\frac{1}{\sqrt{3}}$ (D) $\frac{1}{2}$

141. Consider a group of 5 boys and 7 girls. The number of different teams, consisting of 2 boys and 3 girls that can be formed from this group if there are two specific girls A and B , who refuse to be the members of the same team, is

(A) 350 (B) 300

(C) 200 (D) 500

142. If the mean and the variance of a Binomial variate X are 2 and 1 respectively, then the probability that X takes a value greater than one is equal to

(A) $\frac{5}{16}$ (B) $\frac{11}{16}$

(C) $\frac{12}{16}$ (D) $\frac{15}{16}$

143. The general solution of the differential equation $\frac{dy}{dx} = \frac{y+\sqrt{x^2-y^2}}{x}$ is

(A) $\sin^{-1}y = \log x + c$, where c is a constant of integration.

(B) $\frac{y}{x} = \sin^{-1}x + c$, where c is a constant of integration.

(C) $\frac{y}{x} = \sqrt{x^2-y^2} + c$, where c is a constant of integration.

(D) $\sin^{-1}(\frac{y}{x}) = \log x + c$, where c is a constant of integration.

144. A bag contains 4 red and 3 black balls. One ball is drawn and then replaced in the bag and the process is repeated. Let X denote the number of times black ball is drawn in 3 draws. Assuming that at each draw each ball is equally likely to be selected, then probability distribution of X is given by

(A)

x	0	1	2	3
P(x)	$(\frac{4}{7})^3$	$\frac{9}{7}\cdot(\frac{4}{7})^2$	$\frac{12}{7}\cdot(\frac{3}{7})^2$	$(\frac{3}{7})^3$

(B)

x	0	1	2	3
P(x)	$(\frac{3}{7})^3$	$\frac{12}{7}\cdot(\frac{3}{7})^2$	$\frac{9}{7}\cdot(\frac{4}{7})^2$	$(\frac{4}{7})^3$

(C)

x	0	1	2	3
P(x)	$(\frac{3}{7})^3$	$\frac{9}{7}\cdot(\frac{4}{7})^2$	$\frac{12}{7}\cdot(\frac{3}{7})^2$	$(\frac{4}{7})^3$

(D)

x	0	1	2	3
P(x)	$(\frac{4}{7})^3$	$\frac{12}{7}\cdot(\frac{4}{7})^2$	$\frac{9}{7}\cdot(\frac{3}{7})^2$	$(\frac{3}{7})^3$

145. In a certain culture of bacteria, the rate of increase is proportional to the number present. If there are 10^4 at the end of 3 hours and $4\cdot10^4$ at the end of 5 hours, then there were _____ the beginning.

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

(C) 410^4 (D) $\frac{10^4}{8}$

146. The number of solutions, of $2^{1+|\cos x|+|\cos x|^2+\ldots\ldots\ldots} = 4$ in $(-\pi,\pi)$, is

(A) 2 (B) 3

(C) 4 (D) 6

147. Let $f(x) = x\left[\frac{x}{2}\right]$, for $-10 < x < 10$, where $[t]$ denotes the greatest integer function. Then the number of points of discontinuity of f is equal to

(A) 10 (B) 9

(C) 6 (D) 8

148. Let $\hat{a}$ and $\hat{b}$ be two unit vectors. If the vectors $\overline{c} = \hat{a} + 2\,\hat{b}$ and $\overline{d} = 5\hat{a} + 4\,\hat{b}$ are perpendicular to each other, then the angle between $\hat{a}$ and $\hat{b}$ is

(A) $\frac{\pi}{6}$ (B) $\cos^{-1}(\frac{13}{14})$

(C) $\frac{\pi}{3}$ (D) $\cos^{-1}(\frac{-13}{14})$

149. Integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{x}$ is

(A) $\frac{x}{e^x}$ (B) xe^x

(C) e^x (D) $\frac{e^x}{x}$

150. A service station manager sells gas at an average of ₹ 100 per hour on a rainy day, ₹ 150 per hour on a dubious day, ₹ 250 per hour on a fair day and ₹ 300 on a clear sky. If weather bureau statistics show the probabilities of weather as follows, then his mathematical expectation is

Weather	Clear	Fair	Dubious	Rainy
Probability	0.50	0.30	0.15	0.05

(A) 257.5 (B) 252.5

(C) 250 (D) 247.5

- End of Question Paper -