MHT CET 2022 PCM Aug 10 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 2022**, 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 shell is fired at an angle of 30° to the horizontal with velocity 196 m/s. The time of flight is $\left[\sin 30^\circ = \frac{1}{2} = \cos 60^\circ\right]$

(A) 10 s (B) 16.5 s

(C) 20 s (D) 6.5 s

2. A body moving in a circular path with a constant speed, it has constant

(A) momentum (B) kinetic energy

(C) acceleration (D) velocity

3. Two bodies of masses m and 3 m are rotating in horizontal circles of radius r and $\frac{r}{3}$ respectively. The tangential speed of body of mass m is n times that of the value of heavier body. while the centripetal force is same for both. The value of n is

(A) 3 (B) 9

(C) 1 (D) 6

4. Two massless springs of spring constant K_1 and K_2 are connected one after the other forming a single chain, suspended vertically and certain mass is attached to the free end. If e_1 and e_2 are their respective extensions and f is their stretching force, the total extension produced is

(A) $f(K_1 - K_2)$ (B) $f\left(\frac{1}{K_1} - \frac{1}{K_2}\right)$

(C) $f(K_1 + K_2)$ (D) $f\left(\frac{1}{K_1} + \frac{1}{K_2}\right)$

5. A door 1.2 mwide requires a force of 1 N to be applied perpendicular at the free end to open or close it. The perpendicular force required at a point 0.2 mdistant from the hinges for opening or closing the door is

(A) 2.4 N (B) 3.6 N

(C) 6.0 N (D) 1.2 N

6. The mass and radius of the earth and moon are M_1, R_1 and M_2, R_2 respectively. Their centres are at a distance d apart. The minimum speed with which a body of mass m should be projected from a distance $\left(\frac{2d}{3}\right)$ from the centre of M_1 so as to escape to α is

(A) $\left[\frac{3G(M_1+2M_2)}{d}\right]\frac{1}{2}$ (B) $\left[\frac{3G(M_1-M_2)}{2d}\right]\frac{1}{2}$

(C) $\left[\frac{6G(M_1-M_2)}{2d}\right]^{\frac{1}{2}}$ (D) $\left[\frac{6G(M_1+M_2)}{d}\right]^{\frac{1}{2}}$

7. A body weights 500 Non the surface of earth. At what distance below the surface of earth it weight 250 N ? (Radius of earth, $R = 6400$ km)

(A) 800 km (B) 3200 km

(C) 1600 km (D) 6400 km

8. The work done in blowing a soap bubble of radius R is W_1 at room temperature. Now the soap solution is heated. From the heated solution another soap bubble of radius $2R$ is blown and the work done is W_2. Then

(A) $W_2 = 0$ (B) $W_2 = 4W_1$

(C) $W_2 < 4W_1$ (D) $W_2 = W_1$

9. The excess pressure inside a soap bubble of radius 2 cm is 50 dyne /cm^2. The surface tension is

(A) 25 dyne /cm (B) 60 dyne/ cm

(C) 50 dyne /cm (D) 75 dyne/ cm

10. A bucket containing water is revolved in a vertical circle of radius r .To prevent the water from falling down, the minimum frequency of revolution required is ($g =$ acceleration due to gravity)

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

(C) $\frac{1}{2\pi}\sqrt{\frac{g}{r}}$ (D) $2\pi\sqrt{\frac{g}{r}}$

11. A steel coin of thickness d and density ρ is floating on water of surface tension T. The radius of the coin R is [$g =$ acceleration due to gravity]

(A) $\frac{4T}{3\rho g d}$ (B) $\frac{T}{\rho g d}$

(C) $\frac{2T}{\rho g d}$ (D) $\frac{3T}{4\rho g d}$

12. 22 g of carbon dioxide at 27°C is mixed in closed container with 16 g of oxygen at 37°C. If both gases are considered as ideal gases, then the temperature of the mixture is nearly

(A) 22.2°C (B) 33.5°C

(C) 31.5°C (D) 28.5°C

13. Three discs x, y and z having radii 2 m, 3 m and 6 m respectively are coated on outer surfaces. The wavelength corresponding to maximum intensity are 300 nm, 400 nm and 500 nm respectively. If P_x, P_y and P_z are power radiated by them respectively then

(A) P_y is maximum
(B) P_z is maximum
(C) $P_x = P_y = P_z$
(D) P_x is maximum

14. The thermodynamic process in which the work done on or by the gas is zero

(A) adiabatic process
(B) isochoric process
(C) isothermal process
(D) isobaric process

15. A monoatomic gas $\left(y = \frac{5}{3}\right)$ initially at 27°C having volume V is suddenly compressed to one-eight of its original volume $\left(\frac{V}{8}\right)$. After the compression temperature becomes.

(A) 1160 K
(B) 580 K
(C) 1200 K
(D) 927 K

16. When the rms velocity of a gas is denoted by V, which of the following relation is true? ($T =$ absolute temperature of the gas)

(A) $\frac{V^2}{T} =$ constant
(B) $VT^2 =$ constant
(C) $\frac{V}{T^2} =$ constant
(D) $V^2T =$ constant

17. The time taken by a particle executing simple harmonic motion of period T to move from the mean position to half the maximum displacement is

(A) $\frac{T}{2}s$
(B) $\frac{T}{12}s$
(C) $\frac{T}{6}s$
(D) $\frac{T}{4}s$

18. A particle starts oscillating simple harmonically form its mean position with time period T. At time $t = \frac{T}{12}$, the ratio of the potential energy to kinetic energy of the particle is $\left(\sin 30° = \cos 60° = 0.5,\ \cos 30° = \sin 60° = \frac{\sqrt{3}}{2}\right)$

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

19. Two monoatomic ideal gases A and B of molecular masses m_1 and m_2 respectively, are enclosed in separate containers kept at the same temperature. The ratio of the speed of sound in gas A to that in gas B is given by

(A) $\sqrt{\frac{m_2}{m_1}}$
(B) $\frac{\frac{m_2}{m_1}}{\sqrt{\frac{m_2}{m_1}}}$
(C) $\sqrt{\frac{m_1}{m_2}}$
(D) $\frac{m_2}{m_1}$

20. A stationary wave is represented by $y = 10 \sin\left(\frac{\pi x}{4}\right) \cos(20\pi t)$ where x and y are in cm and t in second. The distance between two consecutive nodes is

(A) 1 cm
(B) 8 cm
(C) 4 cm
(D) 2 cm

21. Two waves are superimposed whose ratio of intensities is 9 : 1. The ratio of maximum and minimum intensity is

(A) 9:1
(B) 4 : 1
(C) 3 : 1
(D) 5 : 3

22. In a medium, the phase difference between two particles separated by a distance x is $\left(\frac{\pi}{5}\right)^\circ$. If the frequency of the oscillation of particles is 25 Hz and the velocity of propagation of the wave is 75 m/s, then the value of x is

(A) 0.1 m
(B) 0.2 m
(C) 0.3 m
(D) 0.4 m

23. A hollow pipe of length 0.8 m is closed at one end. At its open end, a 0.5 m long uniform string is vibrating in its second harmonic and it resonates with the fundamental frequency of pipe. If the tension in the sting is 50 N and speed of sound in air is 320 m/s, the mass of the strings is

(A) 10 g
(B) 20 g
(C) 5 g
(D) 40 g

24. Consider the following statements about stationary waves A. The distance between two adjacent nodes or antinodes is equal to $\frac{\lambda}{2}(\lambda =$ wavelength of the wave) B. A pressure node is always formed at the open end of the open organ pipe. choose the correct option from the following

(A) Only the statement A is true
(B) Only the statement B is true
(C) Both statements A and B are true
(D) Both statements A and B are wrong

25. Three equal charges q_1, q_2 and q_3 are placed on the three corners of a square of side a. If the force between q_1 and q_2 is F_{12} and that between q_1 and q_3 is F_{13}, then the ratio of magnitudes $\left(\frac{F_{12}}{F_{13}}\right)$ is

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

26. If the radius of the spherical Gaussian surface is increased then the electric flux due to a point charge enclosed by the surface

(A) remains unchanged (B) zero

(C) increases (D) decreases

27. A parallel plate capacitor is charged and then disconnected from the charging battery. If the plates are now moved further apart by pulling them by means of insulting handles, then

(A) the capacitance of the capacitor increases (B) the voltage across the capacitor increases

(C) the energy stored in the capacitor decreases (D) the charge on the capacitor decreases

28. The force between the plates of a parallel plate capacitor of capacitance C and distance of separation of the plates d with a potential difference V between the plate is

(A) $\frac{CV^2}{2d}$ (B) $\frac{C^2V^2}{2d^2}$

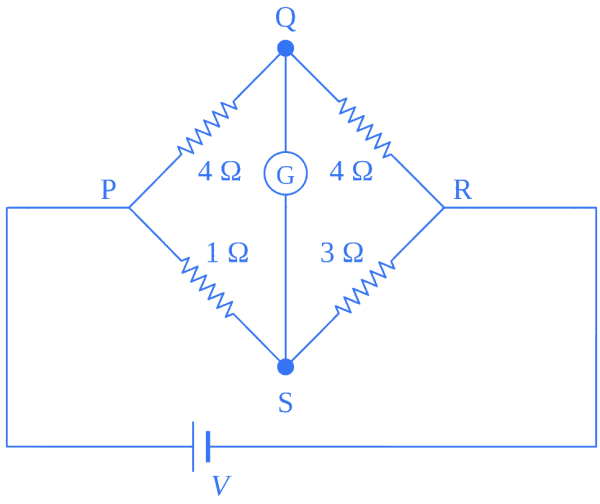
(C) $\frac{C^2V^2}{d^2}$ (D) $\frac{V^2d}{C}$

29. A parallel plate air capacitor has a uniform electric field E in the space between the plates. Area of each plate is A and the distance between the plates is d. The energy stored in the capacitor is [ε_0 = permittivity of free space]

(A) $2\varepsilon_0 EAd$ (B) $\frac{\varepsilon_0 E^2}{2Ad}$

(C) $\frac{1}{2}\varepsilon_0 E^2 Ad$ (D) $\frac{E^2 Ad}{2\varepsilon_0}$

30. In the following network, the current through galvanometer will



(A) be zero (B) flow from Q to S

(C) flow in a direction which depends on value of V (D) flow from S to Q

31. A galvanometer of resistance 200Ω is to be converted into an ammeter. The value of shunt resistance which allows 3% of the main current through the galvanometer is equal to (nearly)

(A) 7Ω (B) 5Ω

(C) 10Ω (D) 6Ω

32. An electron and a proton having same momenta enter perpendicular into a magnetic field then

(A) they will move undeflected (B) curved path of electron and proton will be same. (Neglect sense of revolution)

(C) curved path of electron is more curved than proton (D) path of the proton is more curved

33. Two parallel conducting wires of equal length are placed distance d apart carry current I_1 and I_2 respectively in opposite directions. The resultant magnetic field at the midpoint of the distance between both the wires is

(A) $\frac{\mu_0(I_1-I_2)}{2\pi d}$ (B) $\frac{\mu_0(I_1+I_2)}{2\pi d}$

(C) $\frac{\mu_0(I_1+I_2)}{\pi d}$ (D) $\frac{\mu_0(I_1-I_2)}{\pi d}$

34. The magnetic susceptibility of a material of a rod is 349 and permeability of vacuum μ_0 is $4\pi \times 10^{-7}$SI units. Absolute permeability of the material of the rod in SI units

(A) 4200×10^{-7} (B) 4600×10^{-7}

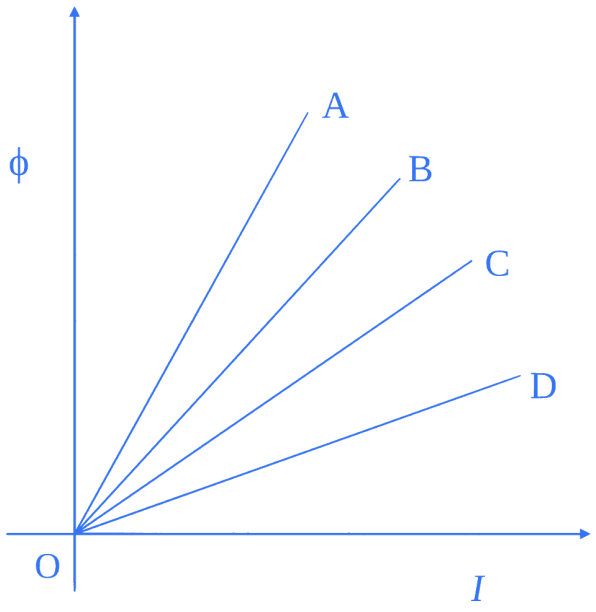
(C) 4400×10^{-7} (D) 4800×10^{-7}

35. Self-induction of a solenoid cannot be increased by

(A) decreasing its length (B) increasing its area of cross-section

(C) increasing the current through it (D) increasing the number of turns in it

36. A graph of magnetic flux (ϕ) versus current (I) is drawn for four inductors A,B,C, D. Larger value of self-inductance is for inductor



(A) A (B) D

(C) C (D) B

37. The magnetic flux through a coil of resistance R changes by an amount $\Delta\phi$ in time Δt. The total quantity of induced electric charge Q is

(A) $\frac{\Delta\phi}{\Delta t}$ (B) $-\frac{\Delta\phi}{\Delta t} + R$

(C) $\frac{\Delta\phi}{R}$ (D) $\frac{\Delta\phi}{\Delta t} \times R$

38. The resistance offered by the inductor (X_L) in an ac circuit is

(A) inversely proportional to inductance and directly proportional to the frequency of alternating current (B) inversely proportional to inductance and frequency of the alternating current

(C) directly proportional to inductance and frequency of alternating current (D) inversely proportional to frequency of alternating current and directly proportional to inductance.

39. A capacitor 50μ Fis connected to a.c. source $e = 220\ \sin(50t)(e$ in volt ,t in second). The value of peak current is

(A) $\frac{0.55}{\sqrt{2}}A$ (B) $\sqrt{2}$

(C) $\frac{\sqrt{2}}{0.55}A$ (D) 0.55 A

40. A coil having an inductance of $\frac{1}{\pi}H$ is connected in series with a resistance of 300Ω. If A.C. source $(20\ \text{V} - 200\ \text{Hz})$ is connected across the combination, the phase angle between voltage and current is

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

(C) $\tan^{-1}\left(\frac{5}{4}\right)$ (D) $\tan^{-1}\left(\frac{3}{4}\right)$

41. The minimum distance between an object and its real image formed by a convex lens of focal length f is

(A) $2.5f$ (B) $2f$

(C) $1.5f$ (D) $4f$

42. The speed of light in two media c_1 and c_2 are 1.5×10^8 m/s and 2×10^8 m/s respectively. If the light undergoes total internal reflection, the critical angle between the two media is

(A) $\sin^{-1}\left(\frac{2}{3}\right)$ (B) $\sin^{-1}\left(\frac{4}{3}\right)$

(C) $\sin^{-1}\left(\frac{3}{2}\right)$ (D) $\sin^{-1}\left(\frac{3}{4}\right)$

43. A parallel beam of monochromatic light falls normally on single narrow slit. The angular width of the central maximum in the resulting diffraction pattern

(A) decrease with decrease of slit width
(B) decreases with increase of slit width
(C) increases with increase of slit width
(D) may increase or decrease

44. In a Fraunhofer diffraction at a single slit of width d and incident light of wavelength 5500 A, the firs minimum is observed at an angle 30°. The first secondary maxima are observed at an angle $\theta =$

(A) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$
(B) $\sin^{-1}\left(\frac{1}{4}\right)$
(C) $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$
(D) $\sin^{-1}\left(\frac{3}{4}\right)$

45. If the kinetic energy of a free electron doubles, its de-Broglie wavelength λ changes by a factor

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

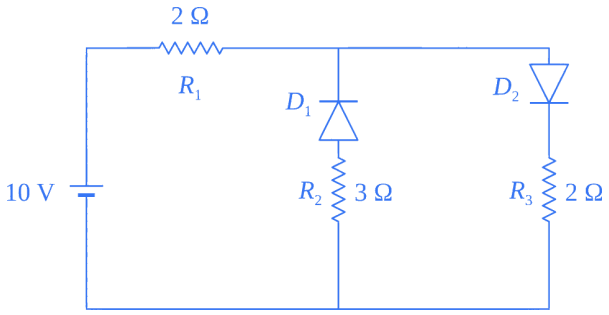
46. Using Bohr's model, the orbital period of electron in hydrogen atom in n^{th} orbit is ($\varepsilon_0 =$ permittivity of vacuum, $h =$ Planck's constant, $m =$ mass of electron, $e =$ electronic charge)

(A) $\frac{4\varepsilon_0^2 n^3 h^3}{me^4}$
(B) $\frac{4\varepsilon_0^2 n^2 h^3}{me^3}$
(C) $\frac{4\varepsilon_0 n h^3}{me^2}$
(D) $\frac{4\varepsilon_0 n^2 h^2}{me^2}$

47. The wave number of the last line of the Balmer series in hydrogen spectrum will be (Rydberg's constant $= 10^7\ \text{m}^{-1}$)

(A) $2.5 \times 10^6\ \text{m}^{-1}$
(B) $0.255 \times 10^9\ \text{m}^{-1}$
(C) $250m^{-1}$
(D) $2.5 \times 10^5\ \text{m}^{-1}$

48. The given circuit has two ideal diodes D_1 and D_2 connected as shown in the figure. The current flowing through the resistance R_1 will be



(A) 2 A
(B) 3.3 A
(C) 2.5 A
(D) 7 A

49. For a NAND gate, the inputs and outputs are given below.

Input A	Input B	Output Y
0	1	C
0	0	D
1	0	E
1	1	F

The values taken by C, D, E, F are respectively

(A) $0, 1, 0, 0$
(B) $1, 0, 1, 1$
(C) $0, 1, 0, 1$
(D) $1, 1, 1, 0$

50. In a full wave rectifier circuit without filter, the output current is

(A) unidirectional but not steady current.
(B) an eddy currents
(C) a sinusoidal current
(D) a constant direct current

51. Which of the following is not hydrogen like species?

(A) He (B) Be^{3+}

(C) He^{+} (D) Li^{2+}

52. What is the bond order of CO molecule?

(A) 0 (B) 2

(C) 1 (D) 3

53. Identify the molecule in which central atom undergoes sp^3 hybridisation?

(A) $BeCl_2$ (B) BF_3

(C) C_2H_4 (D) H_2O

54. Which of the following molecules possesses highest dipole-dipole interaction?

(A) HF (B) HBr

(C) HI (D) HCl

55. Calculate the work done when 2 moles of an ideal gas expand from a volume of $5dm^3$ to $7 \times 10^{-3}\ m^3$ against a constant external pressure of $2.02 \times 10^5 Nm^{-2}$.

(A) 20.2 J (B) 202 J

(C) -35.0 J (D) -404 J

56. Mark out the enthalpy of formation of carbon monoxide (CO).
Given,
$C(s) + O_2(g) \rightarrow CO_2(g),\ \Delta H = -393.3\ kJ/mol$
and
$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g);\ \Delta H = -282.2\ kJ/mol.$

(A) $-111.1\ KJ\ mol^{-1}$ (B) $676.1\ KJ\ mol^{-1}$

(C) $-282.8\ KJ\ mol^{-1}$ (D) $300.0\ KJ\ mol^{-1}$

57. What is the heat of formation of $HCl_{(g)}$ from following equation?
$H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)} \Delta_f H = -194\ kJ$

(A) -388 kJ (B) -97 kJ

(C) -194 kJ (D) 194 kJ

58. If Q is the heat liberated from the system and W is the work done on the system then first law of thermodynamics can be written as

(A) $Q = \Delta U - W$ (B) $Q = -W$

(C) $Q = \Delta U + W$ (D) $Q = W - \Delta U$

59. Which of the following aqueous solutions of salts will have highest pH value?

(A) NaCl (B) CH_3COONH_4

(C) Na_2CO_3 (D) NH_4Cl

60. Which of the following is a Lewis acid but not a Bronsted acid?

(A) HSO_4^- (B) HNO_3

(C) NH_3 (D) BCl_3

61. Which one of the following conversions does not involve either oxidation or reduction?

(A) $VO_2^+ \rightarrow V_2O_3$ (B) $Na \rightarrow Na^+$

(C) $CrO_4^{2-} \rightarrow Cr_2O_7^{2-}$ (D) $Zn^2 \rightarrow Zn$

62. Which from following elements does not react with water?

(A) Sr (B) Mg

(C) Be (D) Ca

63. Which from following pairs of compounds is an example of metamerism?

(A) n-Butane and 2-Methylpropane (B) Dimethyl ether and ethyl alcohol

(C) But-2-ene and But-1-ene (D) Ethoxyethane and methoxypropane

64. Which among the following metals is involved in preparation of Grignard reagent?

(A) Magnesium (B) Sodium

(C) Silver (D) Zinc

65. Identify ether from the following compounds

(A) Methoxymethane (B) Propan $-2-ol$

(C) Benzenol (D) Benzene -1, 2-diol

66. Identify compound A in following reaction Benzene + ozone (excess) $\rightarrow$ Benzenetrizonide $\xrightarrow{A}$ glyoxal

(A) Zn (B) Ni

(C) $Zn - H_2O$ (D) conc. HNO_3

67. Calculate the density of metal having volume of unit cell $64 \times 10^{-24}\ cm^3$ and molar mass of metal $192\ g\ mol^{-1}$ containing 4 particles in unit cell.

(A) $16.00\ g\ cm^{-3}$ (B) $19.93\ g\ cm^{-3}$

(C) $14.92\ g\ cm^{-3}$ (D) $18.00\ g\ cm^{-3}$

68. Calculate the number of atoms in 5 gram metal that crystallises to form simple cubic unit cell structure having edge length 336pm. (Density of metal $= 9.4\ g\ cm^{-3}$)

(A) 1.4×10^{22} (B) 1.8×10^{22}

(C) 1.0×10^{22} (D) 2.1×10^{22}

69. What is the total volume occupied by atoms in bcc unit cell?

(A) 68% (B) 80%

(C) 74% (D) 52.36%

70. Identify the concentration of the solution from following so that values of ΔT_f and K_f are same

(A) 1M (B) 1 m

(C) $\frac{N}{10}$ (D) 1 N

71. What is the pH of 2×10^{-3}M solution of monoacidic weak base if it ionizes to the extent of 5%

(A) 10 (B) 6

(C) 4 (D) 14

72. Calculate the amount of solute dissolved in 160 gram solvent that boils at 85°C. the molar mass of solute is $120\ g\ mol^{-1}$. (K_b for solvent $= 2.7°C kgmol^{-1}$ and boiling point of solvent $= 76°C$)

(A) 64 gram (B) 42 gram

(C) 50 gram (D) 60 gram

73. Calculate the solubility of a gas in water at 0.8 atm and 25°C [Henry's law constant is $6.85 \times 10^{-4}\ moldm^{-3}\ atm^{-1}$]

(A) $5.48 \times 10^{-4}\ moldm^{-3}$

(B) $3.94 \times 10^{-4}\ moldm^{-3}$

(C) $6.858 \times 10^{-4}\ moldm^{-3}$

(D) $2.74 \times 10^{-4}\ moldm^{-3}$

74. How long will it take to produce 5.4 g of Ag from molten AgCl by passing 5amp current? (Molar mass Ag $= 108\ g\ mol^{-1}$) 965

(A) 1930 second (B) 965 second

(C) 193 second (D) 9650 second

75. Calculate $\wedge_0$ of $CH_2ClCOOH$ if $\wedge_0$ for HCl, KCl and $CH_2ClCOOK$ are 4.2, 1.5 and $1.1\Omega^{-1}\ cm^2\ mol^{-1}$ respectively?

(A) $1.9\Omega^{-1}\ cm^2\ mol^{-1}$ (B) $4.2\Omega^{-1}\ cm^2\ mol^{-1}$

(C) $2.7\Omega^{-1}\ cm^2\ mol^{-1}$ (D) $3.8\Omega^{-1}\ cm^2\ mol^{-1}$

76. Which of the following is NOT an example of secondary voltaic cell?

(A) Nickel-cadmium cell (B) Dry cell

(C) Lead storage battery (D) Mercury cell

77. Find the rate constant of first order reaction in second having half-life 2.5 hour?

(A) $6.9 \times 10^{-5}\ sec^{-1}$ (B) $8.4 \times 10^{-5}\ sec^{-1}$

(C) $4.3 \times 10^{-5}\ sec^{-1}$ (D) $7.7 \times 10^{-5}\ sec^{-1}$

78. If rate of reaction is given as $\frac{1}{3}\frac{d[x]}{dt} = -\frac{1}{2}\frac{d[y]}{dt} = -\frac{d[Z]}{dt}$, the reaction can be represented as

(A) $3x + 2y \rightarrow Z$ (B) $2y \rightarrow 3x + Z$

(C) $3x \rightarrow 2Y + Z$ (D) $2Y + Z \rightarrow 3X$

79. For the reaction $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ rate of disappearance of $N_{2(g)}$ is $2.22 \times 10^{-3}\ moldm^{-3}$. What is the rate of appearance of $NH_{3(g)}$?

(A) $4.44 \times 10^{-3}\ moldm^{-3}$

(B) $1.11 \times 10^{-3}\ moldm^{-3}$

(C) $2.22 \times 10^{-3}\ moldm^{-3}$

(D) $3.33 \times 10^{-3}\ moldm^{-3}$

80. What type of following phenomena is NOT exhibited by adsorption?

(A) Exothermic (B) Endothermic

(C) Bulk (D) Irreversible

81. Identify the products obtained when chlorine reacts with hot and conc. NaOH

(A) NaCl and HOCl (B) NaOCl and H_2O

(C) Na_2O and NaCl (D) $NaClO_3$, NaCl and H_2O

82. Which among the following compounds contains highest number of chlorine atoms in their single molecule?

(A) Phosgene
(B) Tear gas
(C) Mustard gas
(D) Phosphine

83. Identify the element with smallest ionic radius in +3 oxidation state from following

(A) Yb
(B) Eu
(C) Er
(D) Lu

84. Which among the following properties of lanthanoids is NOT true?

(A) Have greater coordination number than six
(B) All are non-radioactive elements
(C) Good conductors of heat and electricity
(D) Strongly paramagnetic

85. What is the number of unpaired electrons in $[Co(NH_3)_6]^{+3}$ complex?

(A) Zero
(B) Two
(C) Four
(D) Six

86. Identify the type of hybridization involved in hexaamminecobalt (III) complex ion?

(A) dsp^2
(B) d^2sp^3
(C) $sp^3\ d^2$
(D) sp^3

87. Which among the following methods is used to prepare Grignard reagent?

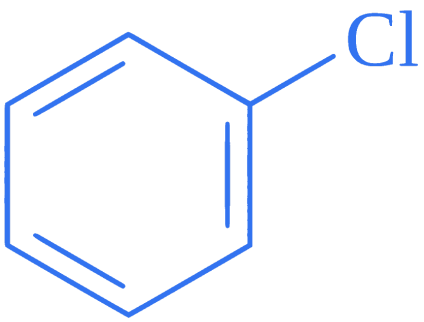
(A) Action of magnesium metal on alkyl halide in presence of dry ether
(B) Action of magnesium powder on alkyl halide in aqueous medium
(C) Action of magnesium hydroxide on alkyl halide
(D) Action of $MgCl_2$ on alkyl halide in presence of dry ether

88. What is the intermediate compound formed when chlorobenzene is treated with fused NaOH under pressure?

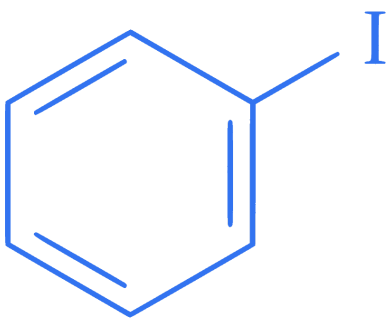
(A) Benzene
(B) Benzene diazonium chloride
(C) Sodium phenoxide
(D) Phenoxide ion

89. Which among the following compounds is NOT prepared by Sandmeyr's reaction?

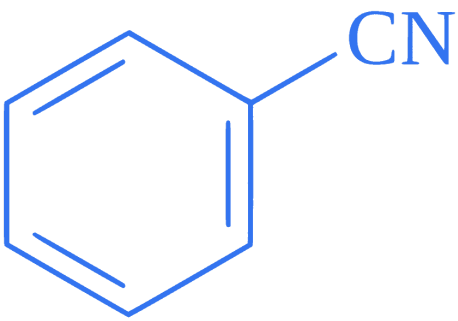
(A)



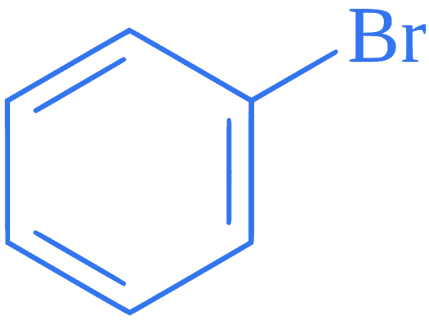
(B)



(C)



(D)



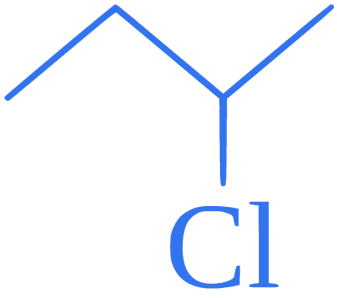
90. Which among the following compounds undergoes SN^2 reaction fastly?



(A)



(B)



(C)



(D)

91. Which among the following reactions does not correctly match with its reagent?

A)	Rosenmund reduction	$H_2/Pd - BaSO_4$
B)	Stephen reaction	$SnCl_2$, HCl
C)	Etard reaction	$CO + HCl\ CrO_2Cl_2$
D)	Gatterman–Koch formulation	$CrO_3/(CH_3CO)_2O$

(A) a (B) b

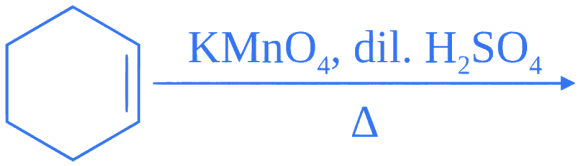
(C) c (D) d

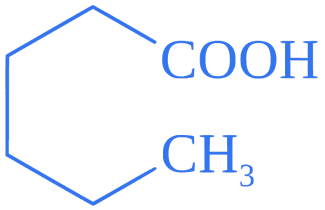
92. What is the product formed when cumene is air oxidized in presence of co-naphthenate and further treated with dilute acid?

(A) Cumene hydroperoxide (B) Phenol + Acetone

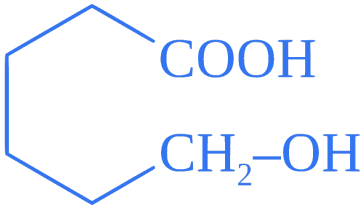
(C) Acetone and Benzoic acid (D) Phenol and CO_2

93. Identify the product in the following reaction.





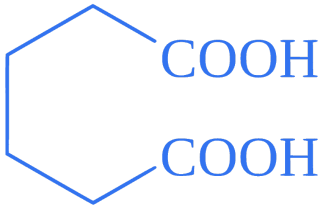
(A)



(B)

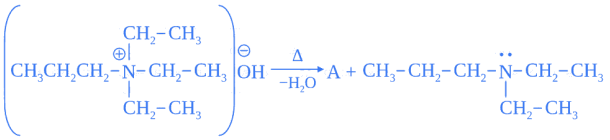


(C)



(D)

94. Identify the product A in the following reaction



(A) $H_2C = CH_2$ (B) $CH_3 - CH_2 - CH_3$

(C) $CH_3 - C \equiv CH$ (D) $CH_3 - CH = CH_2$

95. Which nitrogen atom of pyrimidine base numbered from 1 to 6 is bonded with furanose sugar?

(A) 4 (B) 2

(C) 1 (D) 5

96. Which among following compounds possesses highest number of N atoms in it?

(A) Guanine (B) Thymine

(C) Cytosine (D) Uracil

97. Which among the following pair of monomers does not generate polyamide polymer?

(A) Adipic acid and Hexamethylene diamine (B) Urea and Formaldehyde

(C) Glycine and ϵ amino caproic acid (D) 3-Hydroxybutanoic acid and 3-Hydroxy pentanoic acid

98. Identify the ruse of polystyrene for house hold purposes.

(A) To manufacture disposable cups and plates (B) To prepare bottles for storage of mouth wash

(C) To prepare shopping bags (D) To prepare microwavable food trays

99. Which from following polymers is used to obtain bristles for brushes?

(A) Nylon 2-nylon 6 (B) Nylon 6, 6

(C) Nylon 6 (D) Polyacrylamide

100. Which among the following compounds represents a soap molecule?

(A) Ammonium slat of formic acid (B) Ammonium slat of higher fatty acids

(C) Sodium salt of formic acid (D) Potassium salt of higher fatty acids

101. If the function $f : R - \{-1, 1\} \to A$ defined by $f(x) = \frac{x^2}{1-x^2}$ is surjective, then A is equal to

(A) $R - [-1, 0)$ (B) $R - \{-1\}$

(C) $\{0, \infty)$ (D) $R - (-1, 0)$

102. If $p = \tan 20^\circ$, then value of $\frac{\tan 160^\circ - \tan 110^\circ}{1 + \tan 160^\circ \tan 110^\circ}$, in terms of p is

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

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

103. If $\sin\left(\cot^{-1}(x+1)\right) = \cos\left(\tan^{-1} x\right)$, then the value of x is equal to

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

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

104. The principal solutions of $\cot x + \sqrt{3} = 0$ are

(A) $\frac{5\pi}{6}, \frac{11\pi}{6}$ (B) $\frac{\pi}{6}, \frac{7\pi}{6}$

(C) $\frac{\pi}{6}, \frac{5\pi}{6}$ (D) $\frac{5\pi}{6}, \frac{7\pi}{6}$

105. In a triangle ABC, with usual notations, if $\frac{b+c}{11} = \frac{c+a}{12} = \frac{a+b}{13}$, then $\cos A : \cos B : \cos C =$

(A) 11:12:13 (B) 25:19:7

(C) 7:19:25 (D) 19 : 7 : 25

106. If α and β are the complex cube roots of unity, then $\alpha^3 + \beta^3 + \alpha^{-2} \times \beta^{-2}$ is equal to

(A) 1 (B) -3

(C) 3 (D) 0

107. If $A \equiv (5, 1, p), B \equiv (1, q, p)$ and $C \equiv (1, -2, 3)$ are vertices of the triangle and $G \equiv \left(r, -\frac{4}{3}, \frac{1}{3}\right)$ is its centroid, then the values of p, q, r are respectively

(A) $-1, 3, \frac{7}{3}$ (B) $1, 3, \frac{7}{3}$

(C) $1, -3, \frac{7}{3}$ (D) $-1, -3, \frac{7}{3}$

108. The orthocentre and centroid of triangle are $A(-3, 5)$ and $B(3, 3)$ respectively. If C is the circumcenter of this triangle, then the radius of the circle having line segment AC as a diameter, is units.

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

(C) $2\sqrt{10}$ (D) $\frac{3\sqrt{5}}{2}$

109. The slopes of the lines, making angle of measures 45° with the line $2x - 3y = 5$ are

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

(C) $\frac{1}{5}, -5$ (D) $5, \frac{1}{5}$

110. If θ is an acute angle between the lines $kx^2 - 4xy + y^2 = 0$ and $\tan\theta = \frac{1}{2}$, then value of k is

(A) 21 (B) 4

(C) 3 (D) -3

111. If $f(x) = [x] - \left[\frac{x}{4}\right], x \in R$ Where $[x]$ denotes the greatest integer less than or equal to x, then

(A) $\lim_{x\to 4^-} f(x)$ exists, but $\lim_{x\to 4^+} f(x)$ does not exist.

(B) $f(x)$ is continuous at $x = 4$.

(C) $\lim_{x\to 4^+} f(x)$ exists, but $\lim_{x\to 4^-} f(x)$ does not exist.

(D) Both $\lim_{x\to 4^-} f(x)$ and $\lim_{x\to 4^+} f(x)$ exist, but are not equal.

112. The quadratic equation whose roots are m and n, where $m = \lim_{x\to 0} \frac{x\log(1+2x)}{x\tan x}$ and $n = \lim_{x\to 0} \frac{\log x + \log\left(\frac{(1+x)}{x}\right)}{x}$, is

(A) $x^2 - x + 2 = 0$ (B) $x^2 - 3x + 2 = 0$

(C) $x^2 + x + 2 = 0$ (D) $x^2 + 3x + 2 = 0$

113. Mrs. Rajni deposited Rs. 10,0000 in a bank that pays 4% interest compounded continuously then the amount she gets after 10 years is Rs. approximately. (given $e^{(0.4)} = 1.49182$)

(A) 15150 (B) 16000

(C) 14918 (D) 13000

114. If p and q each have truth value F, then the truth values of the statement patterns $(\sim p \vee q) \leftrightarrow \sim (p \wedge q)$ and $\sim p \leftrightarrow (p \to \sim q)$ respectively are

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

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

115. If statement I: If a quadrilateral $ABCD$ is a square, then all of its sides are equal. Statement II: All the sides of a quadrilateral $ABCD$ are equal, then $ABCD$ is a square. Then

(A) statement II is an inverse of statement I.
(B) statement II is a negation of statement I.
(C) statement II is a converse of statement I.
(D) statement II is a contrapositive of statement I.

116. If $p: 25$ is an odd prime number. $q: 14$ is a composite number and $r: 64$ is a perfect square number. Then which of the following statement pattern is true?

(A) $\sim(q \wedge r) \vee p$
(B) $(p \wedge q) \vee r$
(C) $(p \vee q) \wedge (\sim r)$
(D) $\sim p \vee (q \wedge r)$

117. The sum of 10 values is 12 and the sum of their squares is 16.9 , then their standard deviation (S, D) is

(A) 0.05
(B) 5
(C) 0.5
(D) 0.005

118. The value of $\tan\left(\cos^{-1}\left(\frac{4}{5}\right)+\tan^{-1}\left(\frac{2}{3}\right)\right)$ is

(A) $\frac{6}{17}$
(B) $\frac{7}{16}$
(C) $\frac{16}{7}$
(D) $\frac{17}{6}$

119. If $A=\begin{bmatrix}2 & -3\\ 4 & 1\end{bmatrix}$, then $A+\text{adj}A$ is

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

120. If $A=[a_{ij}]_{3\times3}=\begin{bmatrix}1 & 3 & 3\\ -1 & 2 & 2\\ 1 & 1 & 4\end{bmatrix}$ and A_{ij} is a cofactor of a_{ij} then the value of $a_{31}A_{31}+a_{32}A_{32}+a_{33}A_{33}$ is equal to

(A) 5
(B) 15
(C) 20
(D) 0

121. If $x=\cos^{-1}\left(\frac{1}{\sqrt{1+t^2}}\right), y=\sin^{-1}\left(\frac{1}{\sqrt{1+t^2}}\right)$, then $\frac{dy}{dx}$ is

(A) 0
(B) $\frac{\sin t}{\cos t}$
(C) 1
(D) $\sin t \cdot \cos t$

122. For $x \in \left(0, \frac{1}{4}\right)$, if the derivative of $\tan^{-1}\left(\frac{6x\sqrt{x}}{1-9x^3}\right)$ is $\sqrt{x}\cdot g(x)$, then $g(x)$ equals

(A) $\frac{9}{1+9x^3}$
(B) $\frac{3x}{1-9x^3}$
(C) $\frac{3x\sqrt{x}}{1-9x^3}$
(D) $\frac{3}{1+9x^3}$

123. If $x=t+\frac{1}{t}$ and $y=t-\frac{1}{t}$, the $\frac{dy}{dx}=$

(A) $\frac{1-t^2}{1+t^2}$
(B) $\frac{t^2+1}{t^2-1}$
(C) $\frac{1+t^2}{1-t^2}$
(D) $\frac{t^2-1}{t^2+1}$

124. For $x \in R, f(x)=|\log 2-\sin x|$ and $g(x)=f(f(x))$, then

(A) $g'(0)=-\cos(\log 2)$
(B) g is not differentiable at $x=0$.
(C) $g'(0)=\cos(\log 2)$
(D) g is differentiable at $x=0$ and $g'(0)=-\sin(\log 2)$.

125. The curve $\left(\frac{x}{a}\right)^n+\left(\frac{y}{b}\right)^n=2, n \in N$ touches the line at the point (a, b), then the equation of the line is

(A) $\frac{x}{a}-\frac{y}{b}=2$
(B) $\frac{x}{a}+\frac{y}{2b}=1$
(C) $\frac{x}{a}+\frac{y}{b}=1$
(D) $\frac{x}{a}+\frac{y}{b}=2$

126. For every value of $x \in [1,3]$, the function $f(x)=\frac{1}{8^x}$ is

(A) increasing for $x>2$ and decreasing for $x \leq 2$.
(B) neither increasing nor decreasing.
(C) decreasing.
(D) increasing.

127. The radius of a cylinder is increasing at the rate 2 cm/ sec and its height is decreasing at the rate of 3 cm/ sec, then the rate of change of volume, when radius is 3 cm and the height is 5 cm, is

(A) $44\pi \text{cm}^3/\text{sec}$
(B) $11\pi \text{cm}^3/\text{sec}$
(C) $23\pi \text{cm}^3/\text{sec}$
(D) $33\pi \text{cm}^3/\text{sec}$

128. If $\int \frac{x+1}{\sqrt{2x-1}}\,dx=f(x)\sqrt{2x-1}+C$, where C is an arbitrary constant, then $f(x)$ is equal to

(A) $\frac{2}{3}(x+2)$
(B) $\frac{2}{3}(x-4)$
(C) $\frac{1}{3}(x+4)$
(D) $\frac{1}{3}(x+1)$

129. $\int \frac{1}{3-2\cos 2x}\,dx =$ (where C is constant of integration.)

(A) $\frac{2}{5}\tan^{-1}(5\tan x)+C$

(B) $\frac{1}{\sqrt{5}}\tan^{-1}(\sqrt{5}\tan x)+C$

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

(D) $\frac{1}{5}\tan^{-1}(5\tan x)+C$

130. The value of $\int \frac{2x^{12}+5x^9}{(x^5+x^3+1)^3}\,dx$ is equal to (where C is arbitrary constant.)

(A) $\frac{x^5}{2(x^5+x^3+1)^2}+C$ (B) $\frac{x^{10}}{2(x^5+x^3+1)^2}+C$

(C) $\frac{-x^5}{(x^5+x^3+1)^2}+C$ (D) $\frac{-x^{10}}{2(x^5+x^3+1)^2}+C$

131. $\int \cos\sqrt{x}\,dx =$ (where C is a constant of integration.)

(A) $2[\sqrt{x}\sin\sqrt{x}+\cos\sqrt{x}\,]+C$

(B) $[\sqrt{x}\sin\sqrt{x}-\cos\sqrt{x}]+C$

(C) $2[\sqrt{x}\sin\sqrt{x}-\cos\sqrt{x}]+C$

(D) $[\sqrt{x}\sin\sqrt{x}+\cos\sqrt{x}]+C$

132. $\int_0^2 |2x|\mathrm{d} =$ (where [.] denotes the greatest integer function.)

(A) 4 (B) 3

(C) 2 (D) 5

133. $\int_0^{\pi/2}\sin^5\left(\frac{x}{2}\right)\cdot\sin x\,dx =$

(A) $\frac{1}{7\sqrt{2}}$ (B) $\frac{1}{56\sqrt{2}}$

(C) $\frac{1}{14\sqrt{2}}$ (D) $\frac{1}{28\sqrt{2}}$

134. $\int_{-1/2}^{1/2}\log\left(\frac{1+x}{1-x}\right)dx =$

(A) 0 (B) $\frac{1}{2}$

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

135. The area (in sq. units) bounded by the curves $y=\sqrt{x}, 2y-x+3=0$, X-axis and lying in the first quadrant, is

(A) 6 (B) $\frac{27}{4}$

(C) 9 (D) 18

136. The solution of the differential equation $(1+x)y\,dx+(1-y)x\,dy=0$ is

(A) $\log xy-x+y=C$

(B) $\log\left(\frac{x}{y}\right)-x+y=C$

(C) $\log xy-x-y=C$

(D) $\log(xy)+x-y=C$

137. The particular solution of $\frac{y}{x}\frac{dy}{dx}=\frac{1+y^2}{1+x^2}$ when $x=2, y=1$ is

(A) $\left(1+y^2\right)=2\left(1+x^2\right)$

(B) $2\left(1+y^2\right)=5\left(1+x^2\right)$

(C) $2\left(1+y^2\right)=\left(1+x^2\right)$

(D) $5\left(1+y^2\right)=2\left(1+x^2\right)$

138. A unit vector $\hat{a}$ makes angles $\frac{\pi}{3}$ with $\hat{i}$, $\frac{\pi}{4}$ with $\hat{j}$ and $\theta\in(\theta,\pi)$ with $\hat{k}$, then a value of θ is

(A) $\frac{2\pi}{3}$ (B) $\frac{5\pi}{12}$

(C) $\frac{5\pi}{6}$ (D) $\frac{\pi}{4}$

139. Let $\bar{a}=3\hat{i}+2\hat{j}+x\hat{k}$ and $\bar{b}=\hat{i}-\hat{j}+\hat{k}$, for some real x. Then $|\bar{a}\times\bar{b}|=r$ is possible, if

(A) $0<r\le\sqrt{\frac{3}{2}}$ (B) $r\ge 5\sqrt{\frac{3}{2}}$

(C) $3\sqrt{\frac{3}{2}}<r<5\sqrt{\frac{3}{2}}$ (D) $\sqrt{\frac{3}{2}}\le r\le 3\sqrt{\frac{3}{2}}$

140. If $\bar{a}=\hat{i}+\hat{j}+\hat{k}, \bar{b}=-\hat{i}+2\hat{j}-2\hat{k}$ and $\bar{c}=2\hat{i}-\hat{j}+2\hat{k}$ then $(\bar{a}-\bar{b})\cdot[(\bar{a}\times\bar{b})\times(\bar{a}\times\bar{c})]$ is

(A) -18 (B) 18

(C) 12 (D) -12

141. If the points $A(3,2,1), B(4,x,5), C(4,2,-2)$ and $D(6,5,-1)$ are coplanar, then x has the value

(A) -5 (B) 5

(C) -6 (D) 6

142. If $\bar{a}=\hat{i}+\hat{j}, \bar{b}=2\hat{i}-\hat{k}$, then 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) $(-3,1,-1)$ (B) $(-3,-1,1)$

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

143. If $P(3,2,6)$ is a point in space and Q is a point on the line $\bar{r}=(\hat{i}-\hat{j}+2\hat{k})+\mu(-3\hat{i}+\hat{j}+5\hat{k})$, then the value of μ for which the vector $\overline{PQ}$ is parallel to the plane $x-4y+3z=1$, is

(A) $\frac{1}{4}$ (B) $-\frac{1}{8}$

(C) $\frac{1}{8}$ (D) $-\frac{1}{4}$

144. Let S be the set of all real values of λ such that a plane passing through the points $\left(-\lambda^2,1,1\right), \left(1,-\lambda^2,1\right)$ and $\left(1,1,-\lambda^2\right)$ also passes through the point $(-1,-1,1)$. Then S is equal to

(A) $\{\sqrt{3}\}$ (B) $\{-1,1\}$

(C) $\{-\sqrt{3},\sqrt{3}\}$ (D) $\{-3,+3\}$

145. Let $\bar{n}$ be a vector of magnitude $3\sqrt{3}$ such that it makes equal acute angles with the co-ordinate axes. Then the vactor equation of a plane passing through $(1,-1,2)$ and normal to $\bar{n}$ is

(A) $\bar{r}\cdot(\hat{i}+\hat{j}+\hat{k})=3$

(B) $\bar{r}\cdot(3\hat{i}+3\hat{j}+3\hat{k})=12$

(C) $\bar{r}\cdot(3\hat{i}+3\hat{j}+3\hat{k})=1$

(D) $\bar{r}\cdot(3\hat{i}+3\hat{j}+3\hat{k})=6$

146. The feasible region represented by the inequations $2x+3y\leq 18,\ \ x+y\geq 10, x\geq 0, y\geq 0$ is

(A) a finite set. (B) unbounded.

(C) bounded. (D) an empty set.

147. Three critics review a book. For the three critics, the odds in favour of the book are $(5:2),(4:3)$ and $(3:4)$ respectively. The probability that the majority is in favour of the book is

(A) $\frac{149}{343}$ (B) $\frac{185}{343}$

(C) $\frac{209}{343}$ (D) $\frac{129}{343}$

148. A fair die is tossed twice in succession. If X denotes the number of sixes in two tosses, then the probability distribution of X is given by

(A)

$X=x_i$	0	1	2
P_i	$\frac{25}{36}$	$\frac{5}{18}$	$\frac{1}{36}$

(B)

$X=x_i$	0	1	2
P_i	$\frac{1}{36}$	$\frac{25}{36}$	$\frac{5}{18}$

(C)

$X=x_i$	0	1	2	3	4	5	6
P_i	$\frac{1}{6}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

(D)

$X=x_i$	0	1	2
P_i	$\frac{5}{18}$	$\frac{1}{36}$	$\frac{25}{36}$

149. The total number of ways, of dividing 52 cards amongst 4 players, so that 3 players have 17 cards each and fourth player has just one card, are

(A) $\frac{52!}{(17!)^3}$ (B) $\frac{52!}{(17!)^2}$

(C) $\frac{52!}{17!}$ (D) $\frac{52!}{17}$

150. The probability of success for the Binomial distribution satisfying the relation, $4P(X=4)=P(X=2)$ and having the parameter $n=6$, is

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

(C) $\frac{1}{6}$ (D) $\frac{1}{3}$

- End of Question Paper -