MHT CET 2024 PCM May 15 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**.

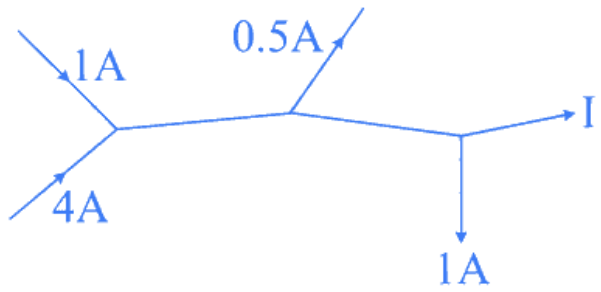
(iii) Each question offers **four choices**, with **one correct answer**.

(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. The figure shows currents in a part of electric circuit. Then current I is



(A) 3.5 A
(B) 1.5 A
(C) 4 A
(D) 2.5 A

2. A metal disc of radius R rotates with an angular velocity ω about an axis perpendicular to its plane passing through its centre in a magnetic field of induction B acting perpendicular to the plane of the disc. The induced e.m.f. between the rim and axis of the disc is

(A) $B\pi R^2$
(B) $\frac{2B\pi^2R^2}{\omega}$
(C) $B\pi R^2\omega$
(D) $\frac{BR^2\omega}{2}$

3. A body of mass m slides down an incline and reaches the bottom with a velocity V . If the same mass were in the form of a disc which rolls down this incline, the velocity of the disc at bottom would have been

(A) $v\sqrt{\frac{3}{4}}$
(B) $v\sqrt{\frac{3}{2}}$
(C) $v\sqrt{\frac{1}{3}}$
(D) $v\sqrt{\frac{2}{3}}$

4. For a particle executing S.H.M. having amplitude A, the speed of the article is $\left(\frac{1}{3}\right)^{rd}$ of its maximum speed when the displacement from the mean position is

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

5. The minimum energy required to launch a satellite of mass m from the surface of a planet of mass M and radius R in a circular orbit at an altitude of $2R$ is

(A) $\frac{5GMm}{6R}$
(B) $\frac{2GMm}{3R}$
(C) $\frac{GMm}{2R}$
(D) $\frac{GMm}{3R}$

6. The core used in transformers are laminated to

(A) increase the magnetic field.
(B) increase the level of the magnetic saturation of the core.
(C) reduce the residual magnetism in the core.
(D) reduce eddy current losses in the core.

7. The end correction for the vibrations of air column in a tube of circular cross-section will be more if the tube is

(A) reduced in length.
(B) increased in length.
(C) made thinner.
(D) widened.

8. If the work done in blowing a soap bubble of volume ' V ' is ' W ', then the work done in blowing a soap bubble of volume ' 2 V ' will be

(A) W
(B) 2 W
(C) $W\sqrt{2}$
(D) $W(4)^{\frac{1}{3}}$

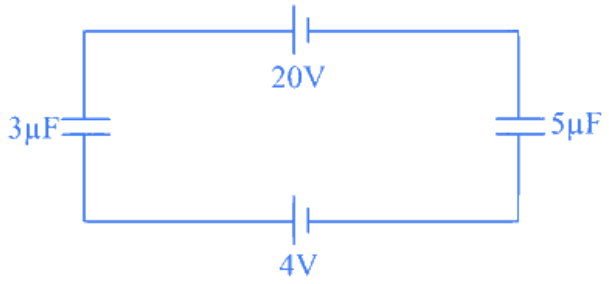
9. A coil has inductance H . The ratio of its reactance when it is connected first to an a.c. source and then to d.c. source is

(A) ∞
(B) zero
(C) one
(D) two

10. A particle of mass m collides with another stationary particle of mass M. The particle m stops just after collision. The coefficient of restitution is

(A) $\frac{m}{M}$
(B) $\frac{M-m}{M+m}$
(C) 1
(D) $\frac{m}{M+m}$

11. In the circuit shown in the following figure, the potential difference cross 3μ F capacitor is



(A) 4 V
(B) 6 V
(C) 10 V
(D) 16 V

12. Sodium light $(\lambda = 6 \times 10^{-7}\ \mathrm{m})$ is used to produce interference pattern. The observed fringe width is 0.12 mm . The angle between the two wave trains is

(A) 5×10^{-1}rad (B) 5×10^{-3}rad

(C) 1×10^{-2}rad (D) 1×10^{-3}rad

13. The motion of a particle is described by the equation $a = -bx$ where ' a ' is the acceleration, x is the displacement from the equilibrium position and b is a constant. The periodic time will be

(A) $\frac{2\pi}{\mathrm{b}}$ (B) $\frac{2\pi}{\sqrt{b}}$

(C) $2\pi\sqrt{b}$ (D) $2\sqrt{\frac{\pi}{b}}$

14. Acceleration of an electron in the first Bohr's orbit is proportional to m = mass of electron, r = radius of the orbit, h = Planck's constant)

(A) $\frac{\mathrm{m^3r^3}}{\mathrm{h^2}}$ (B) $\frac{h^2}{m^2r^3}$

(C) $\frac{\mathrm{h^2}}{\mathrm{mr^3}}$ (D) $\frac{\mathrm{mr^3}}{\mathrm{h^2}}$

15. A cylindrical rod is having temperatures θ_1 and θ_2 at its ends. The rate of heat flow is $\mathrm{Q}J/\mathrm{S}$. All the linear dimensions of the rod are doubled by keeping the temperature constant. The new rate of flow of heat is

(A) 4Q (B) 2Q

(C) $\frac{\mathrm{Q}}{2}$ (D) $\frac{\mathrm{Q}}{4}$

16. A resistor of 50Ω, inductor of self inductance $\left(\frac{3}{\pi^2}\right)$ H and a capacitor of unknown capacity are connected in series to an a.c. source of 100 V and 50 Hz . When the voltage and current are in phase, the value of capacitance is (nearly)

(A) 0.66×10^{-4} F (B) 0.33×10^{-4} F

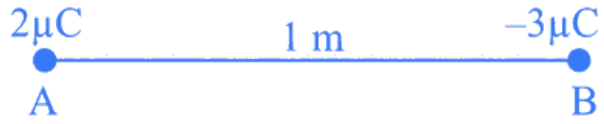
(C) 0.66×10^{-2} F (D) 0.33×10^{-2} F

17. A monoatomic ideal gas, initially at temperature T_1 is enclosed in a cylinder fitted with frictionless piston. The gas is allowed to expand adiabatically to a temperature T_2 by releasing the piston suddenly. L_1 and L_2 are the lengths of the gas columns before and after the expansion respectively. The ratio T_2/T_1 is

(A) $[\frac{\mathrm{L_1}}{\mathrm{L_2}}]^{2/3}$ (B) $[\frac{\mathrm{L_2}}{\mathrm{L_1}}]^{2/3}$

(C) $[\frac{L_2}{L_1}]^{1/2}$ (D) $[\frac{L_1}{L_2}]^{1/2}$

18. Charges of 2μC and -3μC are placed at two points A and B separated by 1 m . The distance of the point from A , where net potential is zero, is



(A) 0.7 m (B) 0.5 m

(C) 0.4 m (D) 0.6 m

19. For detecting light intensity we use

(A) photodiode in reverse bias. (B) photodiode in forwarded bias.

(C) LED in reverse bias. (D) LED in forward bias.

20. A ball is released from the top of a tower of height Hm . It takes T second to reach the ground. The height of the ball from the ground after $\frac{T}{4}$ second is

(A) $\frac{13\mathrm{H}}{14}$ (B) $\frac{15\mathrm{H}}{16}$

(C) $\frac{11\mathrm{H}}{12}$ (D) $\frac{9\mathrm{H}}{10}$

21. 1000 small balls, each weighing 1 gram, strike one square cm of area per second with a velocity 50 m/s in a normal direction and rebound with the same velocity. The value of pressure on the surface will be

(A) $10^7\ \mathrm{N/m^2}$ (B) $10^6\ \mathrm{N/m^2}$

(C) $5 \times 10^6\ \mathrm{N/m^2}$ (D) $2 \times 10^6\ \mathrm{N/m^2}$

22. A wave is given by $Y = 3\sin 2\pi\left(\frac{t}{0.04} - \frac{x}{0.01}\right)$ where Y is in cm . Frequency of the wave and maximum acceleration will be $(\pi^2 = 10)$

(A) 100 Hz, $4.7 \times 10^4\ \mathrm{cm/s^2}$

(B) 50 Hz, $7.5 \times 10^3\ \mathrm{cm/s^2}$

(C) 25 Hz, $4.7 \times 10^4\ \mathrm{cm/s^2}$

(D) 25 Hz, $7.5 \times 10^4\ \mathrm{cm/s^2}$

23. Two concentric circular coils A and B having radii 20 cm and 10 cm respectively lie in the same plane. The current in coil A is 0.5 A in anticlockwise direction. The current in coil B , so that net magnetic field at the common centre is zero, is

(A) 0.5 A in anticlockwise direction. (B) 0.25 A in anticlockwise direction.

(C) 0.25 A in clockwise direction. (D) 0.125 A in clockwise direction.

24. The radius of gyration of a circular disc of radius R and mass m rotating about diameter as axis is

(A) $R\sqrt{2}$ (B) $R/\sqrt{2}$

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

25. What is the current in the following junction diode circuit?



(A) 10^{-1} A (B) zero

(C) 10^{-2} A (D) 5×10^{-3} A

26. When a certain metallic surface is illuminated with monochromatic light wavelength λ, the stopping potential for photoelectric current is $4\,V_0$. When the same surface is illuminated with light of wavelength 3λ, the stopping potential is V_0. The threshold wavelength for this surface for photoelectric effect is

(A) 9λ (B) $\frac{\lambda}{9}$

(C) 3λ (D) $\frac{\lambda}{3}$

27. A plate of refractive index 1.6 is introduced in the path of light from one of the slits in Young's double slit experiment then

(A) the fringe width towards the side of the plate will decrease. (B) the central maximum will shift towards this side

(C) number of fringes seen will decrease. (D) interference pattern will disappear.

28. The viscous force between two liquid layers is

(A) radial. (B) normal to the liquid surface.

(C) tangential to the liquid surface. (D) neither purely tangential nor purely normal.

29. In the given reaction ${}_zX^A \rightarrow {}_{z+1}Y^A \rightarrow {}_{z-1}K^{A-4} \rightarrow {}_{z-1}K^{A-4}$ radioactive radiations are emitted in the sequence

(A) α, β, γ (B) β, α, γ

(C) γ, α, β (D) β, γ, α

30. Two point charges $+q_1$ and q_2 repel each other with a force of 100 N.q_1 is increased by 10% and q_2 is decreased by 10%. If they are kept at their original positions the change in the force of repulsion between them is

(A) decreased by 10 N (B) increased by 10 N

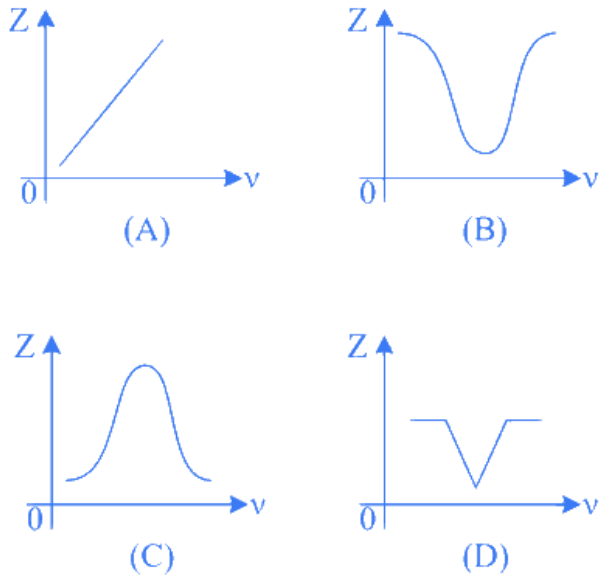
(C) increased by 1 N (D) decreased by 1 N

31. In an ideal gas at temperature T, the average force that a molecule applies on the walls of a closed container depends on T as T^x. The value of x is

(A) 0.25 (B) 2

(C) 0.5 (D) 1

32. Which one of the following graph represent correctly the variation of impedance (Z) of a series LCR circuit with the frequency (v) of applied a.c.?



(A) A (B) B

(C) C (D) D

33. A galvanometer may be converted into ammeter or a voltmeter. In which of the following cases the resistance of the device so obtained will be the largest?

(A) Ammeter of range 1 A (B) Ammeter of range 10 A

(C) Voltmeter of range 1 V (D) Voltmeter of range 10 V

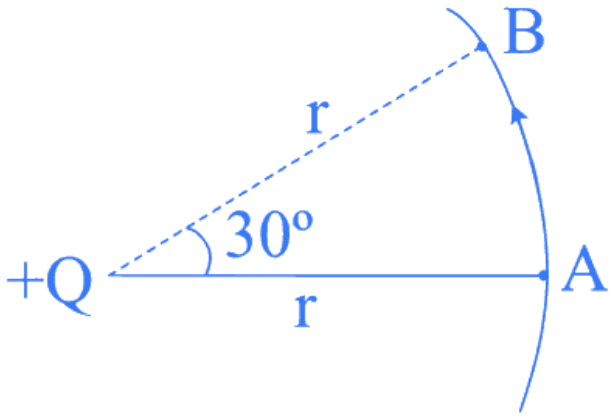
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34. A glass prism ' A ' deviates the red and blue rays through 10° and 12° respectively. A second prism ' B ' deviates them through 8° and 10° respectively. The ratio of their dispersive powers is (A to B)

(A) 9 : 13 (B) 4 : 5

(C) 9 : 11 (D) 8 : 9

35. In an electric field due to charge Q, a charge q moves from point A to B as shown in the figure. The work done is ($\varepsilon_0 =$ permittivity of free space)



(A) $\frac{1}{4\pi\epsilon_0}\frac{Qq}{r^2}$ (B) $\frac{1}{4\pi\epsilon_0}\frac{Qq}{r^2}\frac{\pi}{6}$

(C) $\frac{1}{4\pi\epsilon_0}\frac{Qq}{r}$ (D) zero

36. An air cored coil has a self inductance 0.1 H . A soft iron core of relative permeability 1000 is introduced and the number of turns is reduced $\left(\frac{1}{10}\right)^{\text{th}}$. The value of self inductance is

(A) 0.1 H (B) 1 mH

(C) 1 H (D) 10 mH

37. Heat engine operating between temperature T_1 and T_2 has efficiency $\frac{1}{6}$. When T_2 is lowered by 62 K , its efficiency increases to $\frac{1}{3}$. Then T_1 and T_2 respectively are

(A) 372 K, 310 K (B) 372 K, 330 K

(C) 330 K, 268 K (D) 310 K, 248 K

38. The angle of minimum deviation produced by a thin prism in air is δ_1. If it is immersed in water the angle of minimum deviation is

$$\left[a_g = \frac{3}{2}, a_w = \frac{4}{3}\right]$$

(A) $2\delta_1$ (B) $\frac{\delta_1}{2}$

(C) $\frac{\delta_1}{3}$ (D) $\frac{\delta_1}{4}$

39. An electron is revolving in a circular orbit of radius r in a hydrogen atom. The angular momentum of the electron is L . The relation between dipole moment (m) associated with it, gyromagnetic ratio (R) and L is

(A) $m = -\frac{L}{R}$ (B) $m = -RL$

(C) $m = -RL^2$ (D) $m = \frac{R}{L}$

40. A p-n junction diode as a rectifier converts

(A) a.c. to d.c. (B) d.c. to a.c.

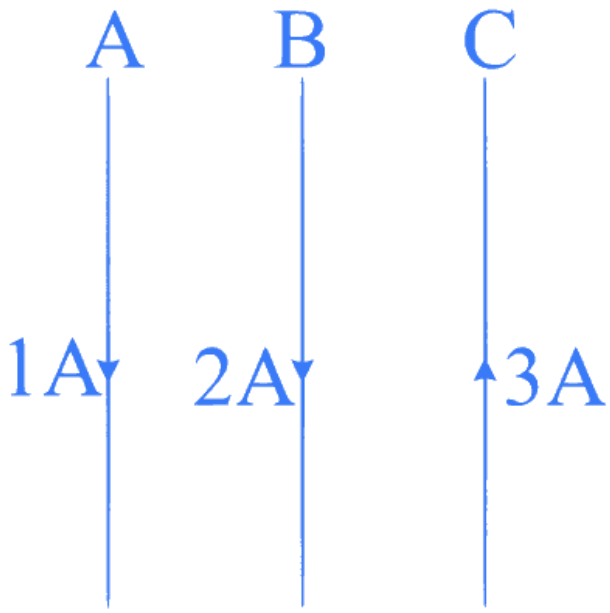
(C) high voltage to low voltage. (D) low voltage to high voltage.

41. A ball rises to surface at a constant velocity in liquid whose density is 3 times greater than that of the material of the ball. The ratio of force of friction acting on the rising ball to its weight is

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

(C) 4 : 1 (D) 6 : 1

42. Three infinite straight wires A, B and C carry currents as shown in figure. The resultant force on wire B is directed



(A) towards A (B) towards C

(C) perpendicular to the plane of page (D) upwards

43. Velocity of sound waves in air is 330 m/s. For a particular sound wave in air, path difference of 40 cm is equivalent to phase difference of 1.6π. frequency of this wave is

(A) 165 Hz (B) 150 Hz

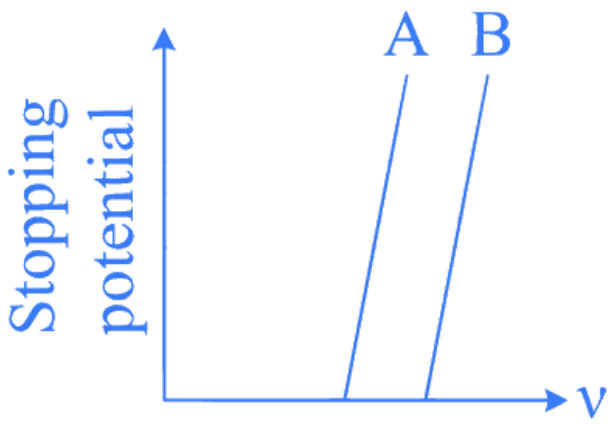
(C) 660 Hz (D) 330 Hz

44. In Young's double slit experiment, the intensity of light at a point on the screen where the path difference is λ is x units, λ being the wavelength of light used. The intensity at a point where the path difference is $\frac{\lambda}{4}$ will be $\left(\cos 2\pi = 1, \cos\frac{\pi}{2} = 0\right)$

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

(C) x (D) zero

45. The stopping potential as a function of frequency of incident radiation is plotted for two different photoelectric surfaces A and B. The graph shows that the work function of A is



(A) greater than that of B. (B) smaller than that of B.

(C) same as that of B. (D) that no comparison can be made from the graphs.

46. The absolute temperature of a gas is determined by

(A) the average momentum of the molecule. (B) the velocity of sound in the gas.

(C) the number of molecules in the gas. (D) the mean square velocity of the molecules.

47. The density of a new planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of earth. If R is the radius of earth, then radius of the planet would be

(A) 4 R (B) $\mathrm{R}/2$

(C) $\frac{\mathrm{R}}{4}$ (D) $2R$

48. A particle is moving in a circle with uniform speed. It has constant

(A) velocity. (B) acceleration.

(C) kinetic energy. (D) displacement.

49. A string has mass per unit length of 10^{-6} kg/cm The equation of simple harmonic wave produced in it is $\mathrm{Y} = 0.2\sin(2\mathrm{x} + 80\mathrm{t})\mathrm{m}$. The tension in the string is

(A) 0.16 N (B) 0.0016 N

(C) 1.6 N (D) 16 N

50. A spring has length L and force constant K . It is cut into two springs of length L_1 and L_2 such that $\mathrm{L}_1 = \mathrm{NL}_2$ (N is an integer). The force constant of spring of length L_1 is

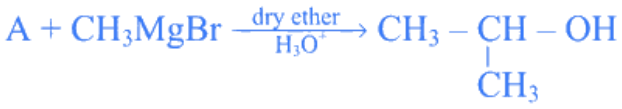
(A) $(\mathrm{N}+1)\mathrm{K}$ (B) $\frac{\mathrm{K}}{\mathrm{N}}(1+\mathrm{N})$

(C) K (D) $\frac{\mathrm{K}}{\mathrm{N}+1}$

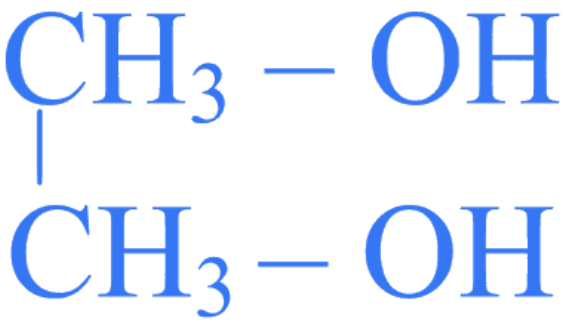
51. Which from following is semisynthetic polymer?

(A) Dacron
(B) Nylon 6
(C) Wool
(D) Cellulose nitrate

52. Identify reactant 'A' in following reaction.



(A) HCHO
(B) CH_3CHO



(C)
(D) CH_3COOH

53. An aqueous solution of strong monoacidic base is of 1×10^{-4}M. What is the value of pH at 25°C ?

(A) 7
(B) 4
(C) 3
(D) 10

54. The correct stability order of alkyl substituted alkenes is

(A) $R_2C = CHR > R_2C = CH_2 > R_2C = CR_2$
(B) $R_2C = CR_2 > R_2C = CHR > R_2C = CH_2$
(C) $R_2C = CH_2 > R_2C = CR_2 > R_2C = CHR$
(D) $R_2C = CR_2 > R_2C = CH_2 > R_2C = CHR$

55. What is the volume occupied by 2.5 mol of ammonia gas at STP?

(A) 22.4 dm^3
(B) 25.0 dm^3
(C) 33.6 dm^3
(D) 56.0 dm^3

56. Which group element from following achieves noble gas configuration after gaining two electrons?

(A) Group-14
(B) Group-15
(C) Group-16
(D) Group-13

57. The reaction given below $2NH_{3(g)} \xrightarrow{Pt} N_{2(g)} + 3H_{2(g)}$ has rate of reaction 2.5×10^{-6} $moldm^{-3}sec^{-1}$ formation of $H_{2(g)}$?

(A) 2.5×10^{-6} mol $dm^{-3}sec^{-1}$
(B) 3.75×10^{-6} mol $dm^{-3}sec^{-1}$
(C) 5.0×10^{-6} mol $dm^{-3}sec^{-1}$
(D) 7.5×10^{-6} mol $dm^{-3}sec^{-1}$

58. Identify the correct statement about glucose from following.

(A) It is aldohexose.
(B) It is nonreducing sugar.
(C) It contains three chiral carbon atoms.
(D) Its ring structure is hemiketal.

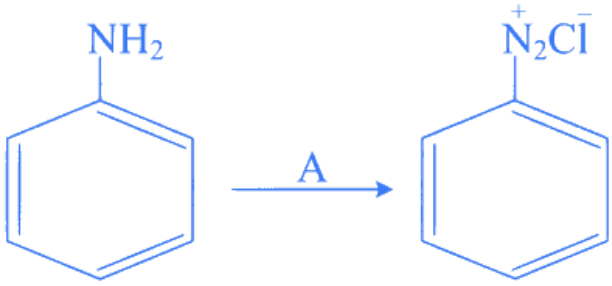
59. In a solid, B^-ions occupy corners of a cube forming ccp structure. If A^+ion occupy half the tetrahedral voids, formula of the solid is

(A) A_2B
(B) AB_2
(C) A_2B_3
(D) AB

60. Calculate the radius of first orbit of He^+.

(A) 26.45 pm
(B) 13.23 pm
(C) 48.62 pm
(D) 39.46 pm

61. Identify reagent 'A' used in the following reaction?



(A) $\xrightarrow[\Delta]{\text{dil. /HCl}}$
(B) $\xrightarrow[\text{low temp.}]{NaNO_2+HCl}$
(C) $\xrightarrow[\Delta]{H_3O^+}$
(D) NaOH, 623 K

62. Acidic buffer solution is prepared by mixing proportionate quantity of

(A) strong acid and its salt with weak base.
(B) strong base and its salt with weak acid.
(C) weak acid and its salt with strong base.
(D) weak base and its salt with strong acid.

63. Which among the following is NOT a feature of S_N2 mechanism?

(A) Single step mechanism.
(B) Backside attack of nucleophile.
(C) Formation of planar carbocation intermediate.
(D) Involves simultaneous bond breaking and bond forming.

64. 3.4 moles of an ideal gas occupies volume of 68 mL at 300 K . What would be the pressure of gas? $\left(\mathrm{R} = 8.314\ \mathrm{J\ K^{-1}\ mol^{-1}}\right)$

(A) 1.247×10^2 kPa
(B) 2.431×10^3 kPa
(C) 1.031×10^5 kPa
(D) 3.247×10^5 kPa

65. Which of the following alloys is used in construction of outer fuselage of ultra-high speed air craft?

(A) Nichrome
(B) Cupra-nickel
(C) Stainless steel
(D) Bronze

66. Calculate the percentage dissociation of 0.05 M solution of weak electrolyte if its molar conductivity and molar conductivity at infinite dilution are respectively. $3.3\Omega^{-1}\ \mathrm{cm^2\ mol^{-1}}$ and $132\Omega^{-1}\ \mathrm{cm^2\ mol^{-1}}$.

(A) 4.0%
(B) 3.5%
(C) 2.5%
(D) 10.0%

67. Identify the polymer used to obtain disposable cups and plates.

(A) LDPE
(B) Polypropylene
(C) HDPE
(D) Polystyrene

68. Beryllium shows diagonal relationship with

(A) Na
(B) Mg
(C) Al
(D) Si

69. Which of the following is a simple ketone?

(A) Acetophenone
(B) Butanone
(C) Benzophenone
(D) Pentan-2-one

70. Calculate molar mass of a solute at 300 K if 400 mg of it is dissolved in 300 mL of water exerts osmotic pressure of 0.2 atm .
$\left(\mathrm{R} = 0.0821\ \mathrm{L\ atm\ K^{-1}\ mol^{-1}}\right)$

(A) 90 g $\mathrm{mol^{-1}}$
(B) 120 g $\mathrm{mol^{-1}}$
(C) 164 g $\mathrm{mol^{-1}}$
(D) 180 g $\mathrm{mol^{-1}}$

71. According to carbinol system tert-butyl alcohol is named as

(A) methyl carbinol
(B) ethyl carbinol
(C) propyl carbinol
(D) trimethyl carbinol

72. A system performs mechanical work equal to 15 kJ and looses 2 kJ of heat to surrounding. What is the change in internal energy of a system?

(A) -15 kJ
(B) -17 kJ
(C) 13 kJ
(D) 19 kJ

73. What is the designation of an orbital with quantum numbers $\mathrm{n} = 4$ and $l = 3$?

(A) 4s
(B) 4p
(C) 4d
(D) 4f

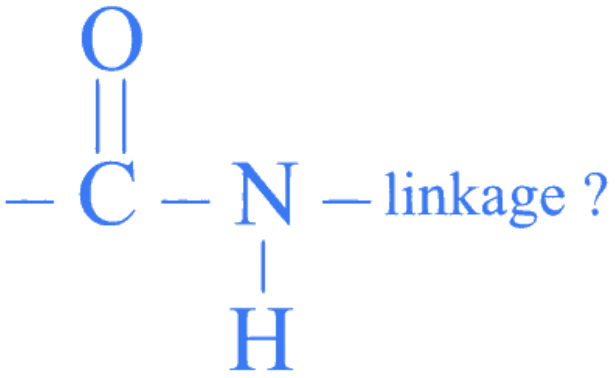
74. Which among the following properties is NOT exhibited by transition elements?

(A) These are generally hard.
(B) These form alloys with other metals.
(C) These do not conduct heat.
(D) These are malleable and ductile.

75. For reaction $\mathrm{A} + \mathrm{B} \rightarrow$ product, rate of reaction is $3.6 \times 10^{-2}\mathrm{sec^{-1}}$. When $[\mathrm{A}] = 0.2\mathrm{moldm^{-3}}$ and $[B] = 0.1\mathrm{moldm^{-3}}$, calculate rate constant of reaction if reaction is first order in A and second order is B ?

(A) 3.6 $\mathrm{mol^{-2}dm^6sec^{-1}}$
(B) 1.8 $\mathrm{mol^{-2}dm^{-6}sec^{-1}}$
(C) 18 $\mathrm{mol^{-2}dm^6sec^{-1}}$
(D) 36 $\mathrm{mol^{-2}dm^{-6}sec^{-1}}$

76. Which of following polymer does not contain



(A) PAN
(B) Nylon 6
(C) Nylon 6,6
(D) Nylon 2,6

77. Unit cell of an element has edge length of 5 $\overset{o}{A}$ with density 4 g cm^{-3}, if its atomic mass is 149, identify the crystal structure.

(A) Simple cubic close packed
(B) Body centred cubic
(C) Face centred cubic
(D) Hexagonal close packed

78. Which among the following gases is difficult to liquify?

(A) SO_2
(B) Cl_2
(C) NH_3
(D) O_2

79. Phenol on heating with zinc dust forms

(A) Benzoquinone
(B) Cyclohexazne
(C) Benzene
(D) Cyclohexanol

80. The degree of dissociation of 0.01 M solution of NH_4OH is 4.2×10^{-2}. What is the percent dissociation of NH_4OH ?

(A) 2.4%
(B) 4.2%
(C) 0.2%
(D) 0.4%

81. Which among the following is an example of odd electron molecule?

(A) BF_3
(B) LiCl
(C) NO
(D) PCl_5

82. Which among the following is a cationic complex?

(A) $Na_4[Fe(CN)_6]$
(B) $[Co(NH_3)_5Cl]SO_4$
(C) $[Ni(CO)_4]$
(D) $K_3[Fe(CN)_6]$

83. The conductivity of 0.02 M solution of $AgNO_3$ is $0.00216\Omega^{-1}$ cm^{-1} at 298 K . What is its molar conductivity?

(A) $232.0\Omega^{-1}$ cm^2 mol^{-1}
(B) $402.0\Omega^{-1}$ cm^2 mol^{-1}
(C) $108.0\Omega^{-1}$ cm^2 mol^{-1}
(D) $150.0\Omega^{-1}$ cm^2 mol^{-1}

84. Which among following is a strongest base?

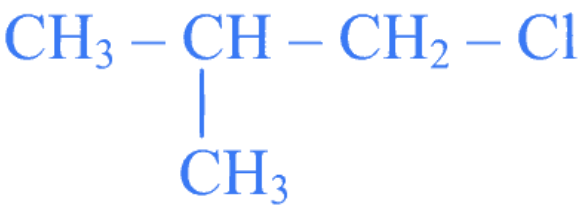
(A) Benzenamine
(B) Phenylmethanamine
(C) N, N-Dimethylbenzenamine
(D) N-Methylbenzenamine

85. What is the vapour pressure of a solution containing 0.1 mol of non volatile solute dissolved in 16.2 g water? ($P_1^0 = 24mmHg$, molar mass of water 18 g mol^{-1})

(A) 12.4 mm Hg
(B) 15.7 mm Hg
(C) 18.1 mm Hg
(D) 21.6 mm Hg

86. Which of the following compounds does not undergo Williamson's synthesis?

(A) C_2H_5Br



(B)
(C) C_6H_5Cl
(D) $CH_3 - CH_2 - CH_2 - Cl$

87. Find the constant external pressure required to expand a gas from 2.5 L to 4.5 L if amount of work done is 500 J at 298 K ?

(A) 1 bar
(B) 1.5 bar
(C) 2.0 bar
(D) 2.5 bar

88. What is change in oxidation number of nitrogen when NO_3^- is converted to NH_4^+ ion?

(A) +5 to −3
(B) +3 to −5
(C) −3 to +5
(D) −5 to +3

89. What type of hybridization is present in $[Co(NH_3)_6]^{3+}$ complex?

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

90. For a reaction $r = k[A][B]^2$, if concentration of A is doubled the rate of reaction

(A) increases by 2
(B) increases by 4
(C) decrease by $\frac{1}{2}$
(D) decreases by 2

91. The correct zwitter ion structure of glycine is

(A) $H_2N - CH_2 - COOH$

(B) $H_3\overset{+}{N} - CH_2 - COO^-$

(C) $H_3\overset{+}{N} - CH_2 - COOH$

(D) $H_2N - CH_2 - COO^-$

92. What is the volume of one particle in BCC structure if ' a ' is edge length?

(A) $\frac{\pi a^3}{3\sqrt{2}}$
(B) $\frac{\pi a^3}{12\sqrt{2}}$
(C) $\frac{\sqrt{3}\pi a^3}{16}$
(D) $\frac{\sqrt{3}\pi a^3}{8}$

93. Identify product ' B ' in following reaction.

$$CH_3 - I + KCN \longrightarrow A \xrightarrow[C_2H_5OH]{Na} B$$

(A) CH_3OH
(B) CH_3ONa
(C) CH_3NO_2
(D) $CH_3CH_2NH_2$

94. Which of the following alkenes does NOT exhibit cis-trans isomerism?

(A) But-1-ene
(B) But-2-ene
(C) 3,4-Dimethylhex-3-ene
(D) Pent-2-ene

95. Carbonated water is an example of a solution of

(A) Gas in liquid
(B) Gas in solid
(C) Gas in gas
(D) Solid in gas

96. Which of the following is vinylic halide?

(A) Haloalkane
(B) Haloalkene
(C) Haloakyne
(D) Haloarene

97. In a particular reaction ' x ' kJ of heat is released by the system and ' y ' kJ of work done is done on the system. What is internal energy change?

(A) $x - ykJ$
(B) $y - xkJ$
(C) $x + ykJ$
(D) $xykJ$

98. Which of the following compounds contains S atom in its ring?

(A) Nitromethane
(B) Pyran
(C) Furan
(D) Thiophene

99. Which element from following combines with hydrogen to form a compound with lowest thermal stability?

(A) F
(B) I
(C) Cl
(D) Br

100. What is the decreasing order of deposition of metal on electrode if standard reduction potentials are given as -
$Ag^+ \,|Ag = 0.80\ V, Cu^{2+}|\, Cu = 0.337\ V$
$Sn^{2+} \,|Sn = -0.136\ V, Cd^{2+}|\, Cd = -0.403\ V$

(A) $Ag > Cu > Sn > Cd$

(B) $Cu > Sn > Cd > Ag$

(C) $Sn > Cd > Ag > Cu$

(D) $Cd > Sn > Cu > Ag$

101. If $x = \sin\theta, y = \sin^3\theta$, then $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{2}$ is

(A) 0 (B) 2

(C) 3 (D) 6

102. Let P, Q, R and S be the points on the plane with position vectors $-2\hat{i} - \hat{j}, 4\hat{i}, 3\hat{i} + 3\hat{j}$ and $-3\hat{i} + 2\hat{j}$ respectively. Then the quadrilateral PQRS must be a

(A) parallelogram, which is neither a rhombus nor a rectangle.

(B) square.

(C) rectangle, but not a square.

(D) rhombus, but not a square.

103. If $y = \frac{x^{\frac{2}{3}} - x^{\frac{-1}{3}}}{x^{\frac{2}{3}} + x^{\frac{-1}{3}}}, x \neq 0$, then $(x+1)^2 y_1 =$

(A) 2 (B) -2

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

104. The Number of values of C that satisfy the conclusion of Rolle's theorem in case of following function $f(x) = \sin 2\pi x, x \in [-1, 1]$ is

(A) 02 (B) 04

(C) 03 (D) zero

105. An open tank with a square bottom, to contain 4000 cubic cm . of liquid, is to be constructed. The dimensions of the tank, so that the surface area of the tank is minimum, are

(A) side of square bottom = 40 cm, height = 10 cm.

(B) side of square bottom = 20 cm, height = 10 cm.

(C) side of square bottom = 10 cm, height = 40 cm.

(D) side of square bottom = 5 cm, height = 160 cm.

106.

$$\int \text{cosec}(x-a) \cdot \text{cosec}\, x dx =$$

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

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

(C) $\frac{1}{\sin a}\log(\sin(x-a)\cdot \text{cosec}\, x) + c$, where c is a constant of integration.

(D) $\frac{-1}{\sin a}\log(\text{cosec}(x-a)\cdot \sin x) + c$, where c is a constant of integration.

107. The contrapositive of the inverse of $p \to (p \to q)$ is

(A) $(\sim p \wedge q) \to p$ (B) $(\sim p \vee q) \to p$

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

108. The area enclosed between the parabola $y^2 = 4x$ and the line $y = 2x - 4$ is

(A) $\frac{17}{3}$ sq. units (B) 15 sq. units

(C) $\frac{19}{3}$ sq. units (D) 9 sq. units

109. There are 3 sections in a question paper and each section contains 5 questions. A candidate has to answer a total of 5 questions, choosing at least one question from each section. Then the number of ways, in which the candidate can choose the questions, is

(A) 750 (B) 1500

(C) 2255 (D) 2250

110. The order of the differential equation, whose solution is $y = (C_1 + C_2)\, e^x + C_3 e^{x+C_4}$, is

(A) 4 (B) 1

(C) 3 (D) 2

111. If the sides of a rectangle are given by the equations $x = -2, x = 6, y = -2, y = 5$, then the equation of the circle, drawn on the diagonal of this rectangle as its diameter, is

(A) $x^2 + y^2 + 4x + 3y + 22 = 0$

(B) $x^2 + y^2 - 4x + 3y - 22 = 0$

(C) $x^2 + y^2 - 4x - 3y - 22 = 0$

(D) $x^2 + y^2 + 4x - 3y + 22 = 0$

112. The solution set of the equation $\tan x + \sec x = 2\cos x$, in the interval $[0, 2\pi]$ is

(A) $\{\frac{\pi}{6}, \frac{7\pi}{6}, \frac{3\pi}{2}\}$ (B) $\{\frac{5\pi}{6}, \frac{7\pi}{6}, \frac{3\pi}{2}\}$

(C) $\{\frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}\}$ (D) $\{\frac{5\pi}{6}, \frac{11\pi}{6}, \frac{3\pi}{2}\}$

113. If one of the lines represented by $ax^2 + 2hxy + by^2 = 0$ is perpendicular to $mx + ny = 18$, then

(A) $an^2 + 2hmn + bm^2 = 0$

(B) $am^2 + 2hmn + bn^2 = 0$

(C) $am^2 - 2hmn + bn^2 = 0$

(D) $an^2 - 2hmn + bm^2 = 0$

114. If $\sin^{-1}\left(\frac{x}{13}\right) + \text{cosec}^{-1}\left(\frac{13}{12}\right) = \frac{\pi}{2}$, then the value of

(A) 4 (B) 12

(C) 5 (D) 11

115. The graphical solution set of the system of inequations $2x + 3y \leq 6, x + 4y \geq 4, x \geq 0, y \geq 0$ is given by

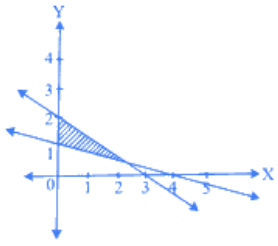


Fig. 1

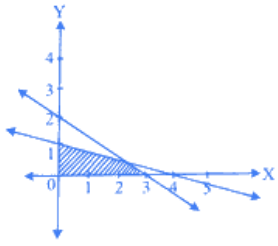


Fig. 2

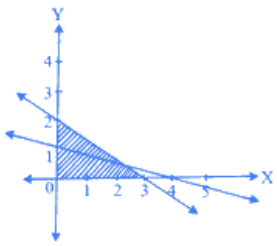


Fig. 3

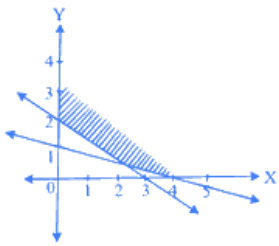


Fig. 4

(A) Fig. 1 (B) Fig. 3

(C) Fig. 2 (D) Fig. 4

116. The derivative of $\sin^{-1}\left(2x\sqrt{1-x^2}\right)$ w.r.t. $\sin^{-1}\left(3x - 4x^3\right)$ is

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

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

117. If $A = \begin{bmatrix} 5a & -b \\ 3 & 2 \end{bmatrix}$ and $A \cdot \text{adj}\, A = AA^T$, then $5a + b$ is equal to

(A) -1 (B) 5

(C) 3 (D) 13

118. The function $f(x) = 2x^3 - 9x^2 + 12x + 2$ is decreasing in

(A) $1 < x < 2$ (B) $x < 1$ or $x > 2$

(C) $x < -1$ or $x > -2$ (D) $-2 < x < -1$

119. $\int \left(1 + x - \frac{1}{x}\right) e^{x+\frac{1}{x}}\, dx$ is equal to

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

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

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

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

120. If the function $f(x) = \begin{cases} -2\sin x & , \text{if } x \leq \frac{-\pi}{2} \\ A\sin x + B & , \text{if } \frac{-\pi}{2} < x < \frac{\pi}{2} \\ \cos x & , \text{if } x \geq \frac{\pi}{2} \end{cases}$ is continuous everywhere, then the values of A and B are respectively

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

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

121.

$$\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \frac{\sqrt{1+\cos x}}{(1-\cos x)^{\frac{5}{2}}} dx =$$

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

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

122. If the complex number $z = x + iy$, where $i = \sqrt{-1}$, satisfies the condition $|z + 1| = 1$, then z lies on

(A) X -axis. (B) circle with centre (1,0) and radius 1 unit.

(C) circle with centre $(-1, 0)$ and radius 1 unit. (D) Y-axis.

123. The general solution of the differential equation $\frac{dy}{dx} = \frac{3e^{2x}+3e^{4x}}{e^x+e^{-x}}$ is

(A) $y = e^{-3x} + c$, where c is a constant of integration.

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

(C) $y = e^{3x} + c$, where c is a constant of integration.

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

124. If $\cos^{-1} x = \alpha (0 < x < 1)$ and $\sin^{-1}\left(2x\sqrt{1-x^2}\right) + \sec^{-1}\left(\frac{1}{2x^2-1}\right) = \frac{2\pi}{3}$, then α is

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{6}$

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

125. If the points P, Q and R are with the position vectors $\hat{i} - 2\hat{j} + 3\hat{k}, -2\hat{i} + 3\hat{j} + 2\hat{k}$ and $-8\hat{i} + 13\hat{j}$ respectively, then these points are

(A) collinear and Q lies between P and R.

(B) collinear and R lies between P and Q.

(C) collinear and P lies between Q and R.

(D) non-collinear.

126. A line makes 45° angle with positive X -axis and makes equal angles with positive Y -axis ad Z-axis respectively, then the sum of the three angles which the line makes with positive X -axis, Y -axis and Z -axis is

(A) 135° (B) 150°

(C) 165° (D) 180°

127. If the lines $\frac{x-1}{2} = \frac{y+2}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect, then k has the value

(A) $\frac{7}{2}$ (B) $\frac{3}{2}$

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

128. The vector equation of the plane through the line of intersection of the planes $x + y + z = 1$ and $2x + 3y + 4z = 5$, which is perpendicular to the plane $x - y + z = 0$, is

(A) $\bar{r} \cdot (\hat{i} - \hat{k}) = 2$ (B) $\bar{r} \cdot (\hat{i} + \hat{k}) + 2 = 0$

(C) $\bar{r} \cdot (\hat{i} + \hat{k}) = 2$ (D) $\bar{r} \cdot (\hat{i} - \hat{k}) + 2 = 0$

129. The equation of motion of a particle is $s = at^2 + bt + c$. If the displacement after 1 second is 20 m , velocity after 2 seconds is 30 m/sec and the acceleration is 10 m/sec^2, then

(A) a + c = 2 b (B) a + c = b

(C) a − c = b (D) a + c = 3b

130. One side and one diagonal of a parallelogram are represented by $3\hat{i} + \hat{j} - \hat{k}$ and $2\hat{i} + \hat{j} - 2\hat{k}$ respectively, then the area of parallelogram in square units is

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

(C) $6\sqrt{2}$ (D) $4\sqrt{3}$

131. If $\int e^{x^2} \cdot x^3 dx = e^{x^2} f(x) + c$ and $f(1) = 0$ (where c is a constant of integration), then the value of $f(x)$ is

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

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

132. If $\cot^{-1}(\sqrt{\cos\alpha}) - \tan^{-1}(\sqrt{\cos\alpha}) = x$, then the value of $\sin x$ is

(A) $\cot^2(\frac{\alpha}{2})$ (B) $\tan^2(\frac{\alpha}{2})$

(C) $\tan\alpha$ (D) $\cot(\frac{\alpha}{2})$

133. If $[x]^2 - 5[x] + 6 = 0$, where $[\cdot]$ denotes the greatest integer function, then

(A) $x \in (2, 4]$ (B) $x \in [2, 4]$

(C) $x \in [2, 4)$ (D) $x \in (2, 4)$

134. The value of the integral $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\cot x}}{\sqrt{\cot x} + \sqrt{\tan x}} dx$ is

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

(C) $\frac{\pi}{8}$ (D) 2π

135. Variance of first n natural numbers is _____.

(A) $n^2 - \frac{1}{12}$ (B) $\frac{(n-1)^2}{12}$

(C) $\frac{n^2}{12} - 1$ (D) $\frac{n^2-1}{12}$

136. Suppose three coins are tossed simultaneously. If X denotes the number of heads, then probability distribution of x is

(A)

$X = x$	0	1	2	3
$P(X = x)$	$\frac{2}{8}$	$\frac{2}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

(B)

$X = x$	0	1	2	3
$P(X = x)$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

(C)

$X = x$	0	1	2
$P(X = x)$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{2}{8}$

(D)

$X = x$	0	1	2	3
$P(X = x)$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$

137. Four fair dice are thrown independently 27 times. Then the expected number of times, at least two dice show up a three or a five is

(A) 11 (B) 12

(C) 9 (D) 10

138. If $0 < x < 1$, then $\sqrt{1+x^2}\left[\left\{x\cos\left(\cot^{-1}x\right)+\sin\left(\cot^{-1}x\right)\right\}^2-1\right]^{\frac{1}{2}}$ is equal to

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

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

139. If the vector $\overline{c}$ lies in the plane of $\overline{a}$ and $\overline{b}$, where $\overline{a}=\hat{i}-\hat{j}+2\hat{k}, \overline{b}=\hat{i}+\hat{j}+\hat{k}$ and $\overline{c}=x\hat{i}-(2-x)\hat{j}-\hat{k}$, then the value of x is

(A) 4 (B) -4

(C) 2 (D) -2

140. The equation of a line passing through the point $(2,-1,1)$ and parallel to the line joining the points $\hat{i}+2\hat{j}+2\hat{k}$ and $-\hat{i}+4\hat{j}+\hat{k}$ is

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

(B) $\overline{r}=(2\hat{i}-\hat{j}+\hat{k})+\lambda(2\hat{i}+6\hat{j}+3\hat{k})$

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

(D) $\bar{r}=(2\hat{i}-\hat{j}+\hat{k})+\lambda(2\hat{i}-6\hat{j}-3\hat{k})$

141. The foot of the perpendicular drawn from origin to a plane is $M(2,1,-2)$, then vector equation of the plane is

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

(B) $r^{-}\cdot(-2\hat{i}-\hat{j}-2\hat{k})=7$

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

(D) $\bar{r}\cdot(2\hat{i}-\hat{j}-\hat{k})=7$

142. If $f(1)=1, f'(1)=3$, then the derivative of $f(f(f(x)))+(f(x))^2$ at $x=1$ is

(A) 12 (B) 30

(C) 15 (D) 33

143. In a triangle ABC , with usual notations, $\frac{\cos B+\cos C}{b+c}+\frac{\cos A}{a}$ has the value

(A) $\frac{1}{b+c}$ (B) $\frac{1}{b}$

(C) $\frac{1}{c}$ (D) $\frac{1}{a}$

144. If $f(x)=\frac{x}{x+1}, x\neq -1$ and $(fof)(x)=F(x)$, then $\int F(x)dx$ is

(A) $\frac{x}{2}+\frac{1}{2}\log(2x+1)+c$, where c is a constant of integration.

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

(C) $\frac{x}{2}-\frac{1}{2}\log(2x+1)+c$, where c is a constant of integration.

(D) $\frac{x}{2}+\frac{1}{4}\log(2x+1)+c$, where c is a constant of integration.

145. If p : The total prime numbers between 2 to 100 are 26.
q : Zero is a complex number.
r : Least common multiple (L.C.M.) of 6 and 7 is 6 .
Then which of the following is correct?

(A) $(p\wedge q)\rightarrow r$ has truth value False.

(B) $(p\rightarrow q)\rightarrow r$ has truth value True.

(C) $(p\vee q)\leftrightarrow r$ has truth value False.

(D) $(p\rightarrow q)\rightarrow(q\rightarrow p)$ has truth value True.

146.

$$\lim_{x\to 2}\frac{3^x+3^{3-x}-12}{3^{3-x}-3^{\frac{x}{2}}}=$$

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

(C) $\frac{2}{3}$ (D) $-\frac{4}{9}$

147.

$$\int_0^{\frac{\pi}{4}}\frac{\sec^2 x}{(1+\tan x)(2+\tan x)}dx=$$

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

(C) $\log(\frac{4}{3})$ (D) $\frac{1}{4}\log(\frac{3}{4})$

148. If two fair dice are rolled, then the probability that the sum of the numbers on the upper faces is at least 9, is

(A) $\frac{1}{3}$ (B) $\frac{4}{11}$

(C) $\frac{5}{18}$ (D) $\frac{5}{36}$

149. After t seconds, the acceleration of a particle, which starts from rest and moves in a straight line is $\left(8-\frac{t}{5}\right)$ cm/s^2, then velocity of the particle at the instant, when the acceleration is zero, is

(A) 160 cm/s (B) 80 cm/s

(C) 320 cm/s (D) 480 cm/s

150. If $A + B = 225^\circ$, then $\frac{\cot A}{1+\cot A} \cdot \frac{\cot B}{1+\cot B}$, if it exists, is equal to

(A) 0 (B) 1

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

- End of Question Paper -