MHT CET 2024 PCM May 2 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 ferromagnetic material is heated above its curie temperature. The correct statement from the following is that

(A) ferromagnetic domains are perfectly arranged.
(B) ferromagnetic domains become random.
(C) ferromagnetic domains are not influenced.
(D) ferromagnetic material changes itself into diamagnetic material.

2. The number of photoelectrons emitted for light of frequency v (higher than the threshold frequency (v_0) is proportional to

(A) threshold frequency (v_0)
(B) intensity of light (I)
(C) frequency of light (v)
(D) work function (ϱ_0)

3. The amount of work done in increasing the voltage across the plates of a capacitor form 5 V to 10 V is ' W '. The work done in increasing it from 10 V to 15 V will be (nearly)

(A) 0.6 W
(B) W
(C) 1.25 W
(D) 1.67 W

4. Liquid drops are falling slowly one by one from vertical glass tube. The relation between the weight of a drop ' w ', the surface tension ' T ' and the radius ' r ' of the bore of the tube is (Angle of contact is zero)

(A) $\mathrm{W}=\pi \mathrm{r}^2$ T
(B) $\mathrm{W}=2 \pi^2 \mathrm{rT}$
(C) $\mathrm{W}=(\frac{4}{3}) \pi^2 \mathrm{rT}$
(D) $\mathrm{W}=2 \pi \mathrm{rT}$

5. A solid sphere of mass ' m ', radius ' R ', having moment of inertia about an axis passing through center of mass as 'I' is recast into a disc of thickness ' t ' whose moment of inertia about an axis passing through the rim (edge) \& perpendicular to plane remains 'I'. Then the radius of disc is

(A) $\frac{2 \mathrm{R}}{\sqrt{15}}$
(B) $(\sqrt{\frac{2}{15}}) \mathrm{R}$
(C) $\frac{4 \mathrm{R}}{\sqrt{15}}$
(D) $\frac{\mathrm{R}}{4}$

6. Rate of flow of heat through a cylindrical rod is ' H_1 '. The temperature at the ends of the rod are ' T_1 ' and ' T_2 '. If all the dimensions of the rod become double and the temperature difference remains the same, the rate of flow of heat becomes ' H_2 '. Then

(A) $\mathrm{H}_2=4 \mathrm{H}_1$
(B) $\mathrm{H}_2=2 \mathrm{H}_1$
(C) $\mathrm{H}_2=\frac{\mathrm{H}_1}{2}$
(D) $\mathrm{H}_2=\frac{\mathrm{H}_1}{4}$

7. A ball rises to surface at a constant velocity in liquid whose density is 4 times greater than that of the material of the ball. The ratio of the force of friction acting on the rising ball and its weight is

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

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

(A) 0.1 H
(B) 1 mH
(C) 1 H
(D) 10 mH

9. $\mathrm{L}=2 \mathrm{H}, \mathrm{C}=5 \mathrm{mF}$ and $\mathrm{R}=12 \Omega$ are connected in series to an a.c. generator of frequency 50 Hz . Then

(A) at resonance, impedance of the circuit is zero.
(B) at resonance, impedance of the circuit is 12Ω.
(C) the resonant frequency of the circuit is $1 / 2 \pi$.
(D) the inductive reactance is less than the capacitive reactance.

10. An electron of stationary Hydrogen atom passes from fifth energy level to ground level. The velocity that the atom acquired as a result of photo to emission is
(m = mass of electron, R = Rydberg's constant)
(h = Planck's constant)

(A) $\frac{24 \mathrm{Rh}}{25 \mathrm{~m}}$
(B) $\frac{25 \mathrm{Rh}}{24 \mathrm{~m}}$
(C) $\frac{25 \mathrm{~m}}{24 \mathrm{Rh}}$
(D) $\frac{24 \mathrm{~m}}{25 \mathrm{Rh}}$

11. A diffraction pattern is obtained using a beam of red light. If red light is replaced by blue light then

(A) no change in diffraction pattern.
(B) diffraction bands become narrow and crowded together.
(C) diffraction bands become broader and farther apart.
(D) bands disappear.

12. The magnetic energy in an inductor changes from maximum value to minimum value in 5 ms . When connected to an a.c. source, the frequency of the source is

(A) 50 Hz
(B) 200 Hz
(C) 500 Hz
(D) 20 Hz

13. Which of the following statement is correct?

(A) Electric lines of force originate from a -vely charged object and terminate on a +vely charged object.
(B) The electric line of force do not pass through an insulator but can pass through a conductor.
(C) The electric line of force do not intersect each other.
(D) Electric intensity is small in a region where the lines of force are crowded.

14. The potential barrier in p-n junction diode is due to

(A) depletion of positive charges near the junction.
(B) accumulation of positive charges near the junction.
(C) depletion of negative charges near the junction.
(D) accumulation of positive and negative charges near the junction.

15. An inclined plane makes an angle of 30° with the horizontal. A solid sphere rolling down this inclined plane from rest without slipping has a linear acceleration (g = acceleration due to gravity, $\sin 30^\circ = 0.5$)

(A) $\frac{2g}{3}$
(B) $\frac{5g}{14}$
(C) $\frac{g}{3}$
(D) $\frac{5g}{7}$

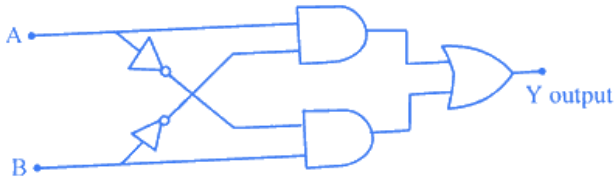
16. A fixed mass of gas at constant pressure occupies a volume ' V '. The gas undergoes a rise in temperature so that the r.m.s. velocity of the molecules is doubled. The new volume will be

(A) $\frac{V}{2}$
(B) $\frac{\mathrm{V}}{\sqrt{2}}$
(C) 2 V
(D) 4 V

17. When cell of E.M.F. ' E_1 ' is connected to potentiometer wire, the balancing length is l_1. Another cell of E.M.F. ' E_2 ' $(E_1 > E_2)$ is connected so that two cells oppose each other, then the balancing length is l_2. The ratio $E_1 : E_2$ is

(A) $\frac{l_1}{l_1+l_2}$
(B) $\frac{l_1}{l_1-l_2}$
(C) $\frac{l_1+l_2}{l_1}$
(D) $\frac{l_1+l_2}{l_1-l_2}$

18. The logic gate combination circuit shown in the figure performs the logic function of



(A) OR gate
(B) NOR gate
(C) XOR gate
(D) NAND gate

19. In an isobaric process

(A) pressure is constant.
(B) volume is constant.
(C) temperature is constant.
(D) internal energy is constant.

20. A concave mirror of focal length ' f ' produces an image ' n ' time the size of the object. If the image is real, then the distance of the object from the mirror is

(A) $(\mathrm{n}-1)\mathrm{f}$
(B) $(\frac{\mathrm{n}-1}{\mathrm{n}})\mathrm{f}$
(C) $(\frac{n+1}{n})f$
(D) $(\mathrm{n}+1)\mathrm{f}$

21. A drum of radius ' R ' full of liquid of density ' d ' is rotated at angular velocity ' ω ' rad/s. The increase in pressure at the centre of the drum will be

(A) $\frac{\omega^2 R^2 d}{2}$
(B) $\frac{\omega^2 \mathrm{Rd}}{2}$
(C) $\frac{\omega \mathrm{Rd}^2}{2}$
(D) $\frac{\omega^2 R^2 d^2}{2}$

22. In a vibrating string with fixed ends the waves are of type

(A) stationary longitudinal.
(B) stationary transverse.
(C) progressive transverse.
(D) progressive longitudinal.

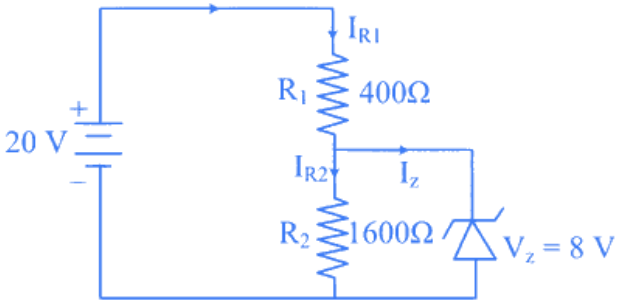
23. The focal length of combination of lenses formed with lenses having power of $+2.50$ D and -3.75 D will be

(A) -20 cm
(B) -40 cm
(C) -60 cm
(D) -80 cm

24. The current flowing in a coil is 3 A and the power consumed is 108 W . If the a.c. source is of 120 V, 50 Hz, the resistance in the circuit is

(A) 24Ω
(B) 36Ω
(C) 12Ω
(D) 6Ω

25. In the following circuit, the current flowing through zener diode is



(A) 35 mA
(B) 25 mA
(C) 15 mA
(D) 5 mA

26. The mass of the lift is 200 kg , when it ascends with an acceleration of 4 m/s^2 then the tension in the cable supporting the lift will be [Given: Acceleration due to gravity $g = 10$ m/s^2]

(A) 800 N
(B) 2800 N
(C) 4200 N
(D) 2000 N

27. The average translational kinetic energy of nitrogen (molar mass 28) molecules at a particular temperature is 0.042 eV . The translational kinetic energy of oxygen molecules (molar mass 32) in eV at double the temperature is

(A) 0.021
(B) 0.048
(C) 0.056
(D) 0.084

28. A spring has a certain mass suspended from it and its period of vertical oscillations is T_1. The spring is now cut into two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillations is now T_2. The ratio of T_2/T_1 is

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

29. The intensity ratio of the maxima and minima in an interference pattern produced by two coherent sources of light is 9 : 1. The intensities of the light sources used are in the ratio

(A) 3 : 1
(B) 4 : 1
(C) 9 : 1
(D) 10 : 1

30. The coil and magnet are moved in the same direction with same speed (V). The induced e.m.f. is



(A) zero.
(B) proportional to V.
(C) proportional to V^{-1} .
(D) finite but does not depend on V.

31. A driver applies the brakes on seeing the red traffic signal 400 m ahead. At the time of applying brakes, the vehicle was moving with 15 m/s and retarding at 0.3 m/s^2. The distance covered by the vehicle from the traffic light one minute after application of brakes is

(A) 375 m
(B) 360 m
(C) 40 m
(D) 25 m

32. The driver of a car travelling with a speed ' V_1 ' m/s towards a wall sounds a siren of frequency ' n ' Hz. If the velocity of sound in air is ' V ' m/s, then the frequency of the sound reflected from the wall and as heard by the driver in Hz is

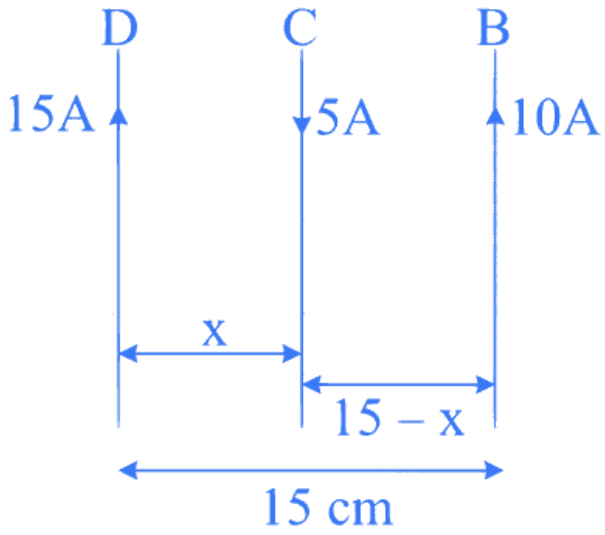
(A) $(\frac{V_1}{V-V_1})n$
(B) $(\frac{V_1-V}{V+V_1})n$
(C) $(\frac{V+V_1}{V-V_1})n$
(D) $(\frac{V-V_1}{V+V_1})n$

33. A stretched string is fixed at both ends. It is made to vibrate so that the total number of nodes formed in it is ' x '. The length of the string in terms of the wavelength of waves formed in it is ($\lambda =$ wavelength)

(A) $\frac{X\lambda}{2}$ (B) $(X+\frac{1}{2})\frac{\lambda}{2}$

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

34. Three long, straight parallel wires carrying currents are arranged as shown. The wire C which carries a current of 5.0 A is so placed that it experiences no force. The distance of wire C from wire D is



(A) 9 cm (B) 7 cm

(C) 5 cm (D) 3 cm

35. Which of the following statements about the Bohr model of the hydrogen atom is false?

(A) Acceleration of electron in n = 2 orbit is less than that in $n = 1$ orbit.

(B) Angular momentum of electron in n = 2 orbit is more than that in $n = 1$ orbit.

(C) Kinetic energy of electron in n = 2 orbit is less than that in n = 1 orbit.

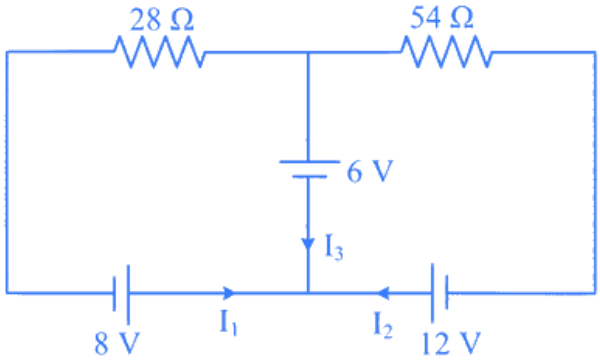
(D) Potential energy of electron in n = 2 orbit is less than that in $n = 1$ orbit.

36. Two points separated by a distance of 0.1 mm can just be seen in microscope when light of wavelength 6000 $\overset{o}{A}$ is used. If the light of wavelength 4800 $\overset{o}{A}$ is used, the limit of resolution will become

(A) 0.8 mm (B) 0.12 mm

(C) 0.10 mm (D) 0.08 mm

37. In the following circuit, the current I_2 is



(A) 5 A (B) 3 A

(C) −3A (D) $-\frac{5}{6}$ A

38. The first operation involved in a carnot cycle is

(A) isothermal expansion.

(B) adiabatic expansion.

(C) isothermal compression.

(D) adiabatic compression.

39. The gravitational potential energy required to raise a satellite of mass ' m ' to height ' h ' above the earth's surface is ' E_1 '. Let the energy required to put this satellite into the orbit at the same height be ' E_2 '. If M and R are the mass and radius of the earth respectively then $E_1 : E_2$ is

(A) h : R (B) h : 2R

(C) R : h (D) 2 h : R

40. The core used in transformer and other electromagnetic devices is laminated to

(A) increase the magnetic field.

(B) increase the level of magnetic saturation of the core.

(C) reduce the residual magnetism in the core.

(D) reduce eddy current.

41. The temperature at which r.m.s. velocity of hydrogen molecules is 4.5 times that of an oxygen molecule at 47°C is (Molecular weight of hydrogen and oxygen molecules are 2 and 32 respectively)

(A) 47°C (B) 132°C

(C) 320°C (D) 405°C

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42. A sonometer wire is stretched by hanging a metal bob. The fundamental frequency of vibration of wire is ' n_1 '. When the bob is completely immersed in water, the frequency of vibration of wire becomes ' n_2 '. The relative density of the metal of the bob is

(A) $\frac{n_1}{n_1-n_2}$ (B) $\frac{H_2}{n_1-n_2}$

(C) $\frac{n_1^2}{n_1^2-n_2^2}$ (D) $\frac{n_2^2}{n_1^2-n_2^2}$

43. For a body performing simple harmonic motion, its potential energy is E_x at displacement x and E_y at displacement y from mean position. The potential energy E_0 at displacement $(x+y)$ is

(A) $\sqrt{E_x^2+E_y^2}$

(B) $\sqrt{E_x-E_y}$

(C) E_x+E_y

(D) $E_x+E_y+2\sqrt{E_xE_y}$

44. Charge on a parallel plate capacitor of capacity C is Q , the electric field intensity between its two plates separated by a distance of t is

(A) $\frac{Qt}{C}$ (B) $\frac{Q}{Ct}$

(C) $\frac{C}{Qt}$ (D) $\frac{Ct}{Q}$

45. Four point charges each +q is placed on the circumference of a circle of diameter 2 d in such a way that they form a square. The potential at the centre is proportional to

(A) $\frac{q^2}{d^2}$ (B) $\frac{q}{d}$

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

46. A meter scale is supported on a wedge at its centre of gravity. A body of weight ' w ' is suspended from the 20 cm mark and another weight of 25 gram is suspended from 74 cm mark balances it and the meter scale remains perfectly horizontal. Neglecting the weight of the meter scale, the weight of the body is

(A) 33 gram wt. (B) 30 gram wt.

(C) 20 gram wt. (D) 15 gram wt.

47. The stopping potential for a photelectric emission process is 10 V . The maximum kinetic energy of the electrons ejected in the process is [Charge on electron e $= 1.6 \times 10^{-19}$C]

(A) 3.2×10^{-19} J (B) 1.6×10^{-19} J

(C) 1.6×10^{-18} J (D) 0 J

48. Cyclotron is used to

(A) accelerate neutrons. (B) accelerate positively charged particles only.

(C) accelerate negatively charged particles only. (D) accelerate positively and negatively charged particles.

49. The displacement of a particle performing S.H.M. is given by $Y = A\cos[\pi(t+\phi)]$. If at t $= 0$, the displacement is y $= 2$ cm and velocity is 2π cm/s, the value of amplitude A in cm is

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

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

50. The string of pendulum of length ' L ' is displaced through 90° from the vertical and released. Then the maximum strength of the string in order to withstand the tension, as the pendulum passes through the mean position is (m = mass of pendulum, g = acceleration due to gravity)

(A) mg (B) 3 mg

(C) 5 mg (D) 6 mg

51. Which of the following orbitals have same value of $(n + l)$ as that of 3 d orbital?

(A) 4s (B) 3s
(C) 4p (D) 2p

52. What is the number of moles of sulfur atoms present in n mole molecules of mustard gas?

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

53. Which of the following is a tricarboxylic acid?

(A) Propionic acid (B) Oxalic acid
(C) Malonic acid (D) Citric acid

54. What is the value of slope, if $\log_{10}$ K (y-axis) is plotted versus 1/T (x-axis) for Arrhenius equation?

(A) $\log_{10}$A (B) $\frac{2{\cdot}303R}{E_a}$
(C) $\frac{-E_a}{2{\cdot}303R}$ (D) $-\log_{10}$A

55. Identify a compound having highest thermal stability.

(A) ICl (B) BrCl
(C) BrF (D) ClF

56. Which among the following has highest basic strength?

(A) Ammonia (B) Ethylamine
(C) Diethylamine (D) Triethylamine

57. Identify the nitrogen atom of purine base that bonds with 1′ carbon of ribose to form ribonucleoside?

(A) 1^{st} (B) 3^{rd}
(C) 7^{th} (D) 9^{th}

58. The resistance of a conductivity cell of 0.1 M KCl solution is 120 ohm and conductivity is 1.64×10^{-4} S cm^{-1}. What is the value of cell constant?

(A) 0.0136 cm^{-1} (B) 0.0196 cm^{-1}
(C) 0.0618 cm^{-1} (D) 0.0731 cm^{-1}

59. What is the percentage of p-bromoanisole formed in the bromination of anisole with bromine in acetic acid?

(A) 10% (B) 60%
(C) 30% (D) 90%

60. Which of the following compounds contains chlorine in +5 oxidation state?

(A) $HClO_4$ (B) $HClO_2$
(C) $HClO_3$ (D) HCl

61. Which from following n mole molecules of carbohydrate contains 2 n mole molecules of galactose, n moles of glucose and n moles of fructose in it?

(A) Lactose (B) Raffinose
(C) Amylose (D) Stachyose

62. Calculate $[H_3O^+]$ of a monobasic acid if it is 0.04% dissociated in 0.05 M solution.

(A) 1×10^{-5} (B) 1.5×10^{-5}
(C) 2.0×10^{-5} (D) 3.0×10^{-5}

63. Identify an aromatic, mixed, 3° amine among the following compounds.

(A) $C_6H_5NHC_2H_5$ (B) $(C_2H_5)_3N$
(C) $(CH_3)_3N$ (D) $C_6H_5N(CH_3)_2$

64. Which of the following changes occurs during the discharging of lead accumulator?

(A) $Pb_{(s)}$ is reduced (B) H_2SO_4 is consumed
(C) $PbSO_4$ is consumed (D) PbO_2 is produced

65. Identify false statement form following.

(A) The boiling point of solution containing non volatile solute is always higher than pure solvent.

(B) At any temperature the vapour pressure of solution containing non volatile solute is lower than that of pure solvent.

(C) The boiling point of liquid is the temperature at which its vapour pressure equals atmospheric pressure.

(D) The molal elevation constant is the boiling point elevation produced by 1 molar solution.

66. Which form following is a use of polyester fibres?

(A) Making bristles of brushes.

(B) To obtain orlon.

(C) To obtain electric insulators.

(D) To obtain terywool.

67. Calculate the solubility product of sparingly soluble salt BA at 300 K if its solubility is $9.1 \times 10^{-3} \text{moldm}^{-3}$ at same temperature.

(A) 9.635×10^{-5}

(B) 9.012×10^{-5}

(C) 8.281×10^{-5}

(D) 7.816×10^{-5}

68. Which of the following is a pair of dihydric phenols?

(A) Resorcinol and pyrogallol

(B) Quinol and phloroglucinol

(C) Phloroglucinol and pyrogallol

(D) Cetechol and Quinol

69. Which compound is used in medicine as barium meal for intestinal x-ray?

(A) Barium chloride

(B) Barium sulphate

(C) Barium sulphide

(D) Barium nitrate

70. If 100 L gas is enclosed in a cylinder, absorbs 302.6 J of heat and expands to 200 L against constant external pressure of 2 atm . Calculate internal energy change of the gas.

(A) 200 J

(B) - 19962 J

(C) -20665 J

(D) -21665 J

71. What is the molar mass of third member of homologous series if the molar mass of first member is 46 g ?

(A) 60 g

(B) 74 g

(C) 138 g

(D) 80 g

72. Idertify chiral molecule from following.

(A) 2 - Chloropropane

(B) 2 - Chloro - 2 - methylbutane

(C) 2 - Chlorobutane

(D) 3-Chloropentane

73. Which from following solids exhibits isotropic properties?

(A) Diamond

(B) Graphite

(C) Sodium

(D) Metallic glass

74. Which from following molecules is tetrahedral?

(A) C_2H_2

(B) CH_4

(C) $BeCl_2$

(D) BF_3

75. Which of the following equations is true for 8.8×10^{-2} kg of carbon dioxide gas?

(A) $PV = 1.5RT$

(B) $PV = RT$

(C) $PV = 2RT$

(D) $PV = 3RT$

76. Identify thermosetting polymer from following.

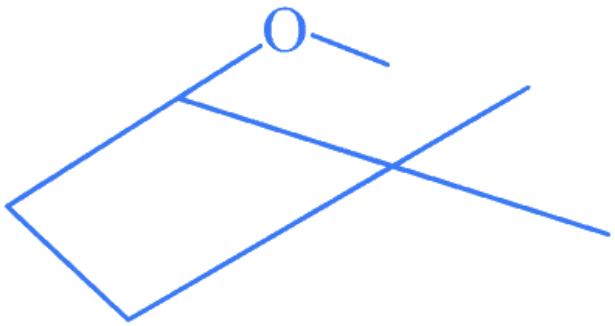
(A) Urea formaldehyde resin

(B) Polystyrene

(C) Polyesters

(D) Polyamides

77. What is the IUPAC name of following compound?



(A) 1-Methoxy - 2,2 - dimethylcyclobutane

(B) 1 - Methoxy -4, 4-dimethylcyclobutane

(C) 2 - Methoxy - 1,1 - dimethylcyclobutane

(D) 2,2 - dimethylcyclobutoxymethane

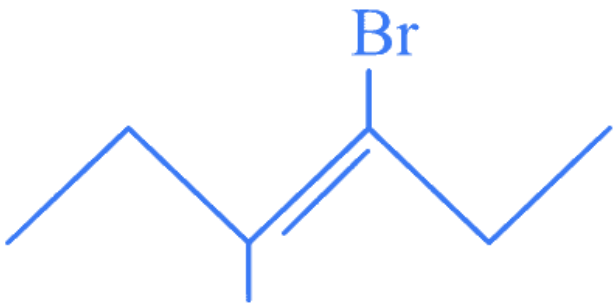
78. Which of the following is true for the value of $\Delta H - \Delta U$ at constant volume?

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

79. Which from following nanomaterials has two dimensions less than 100 nm ?

(A) Nano wires
(B) Microcapsules
(C) Quantum dots
(D) Nanorings

80. What is IUPAC name of the following compound?



(A) 3 - Bromo - 4 - ethylbut - 3 - ene
(B) 3 - Bromo - 4 - methylhex - 3 - ene
(C) 4 - Bromo - 3 - methylhex - 3 - ene
(D) 4-Bromo - 4 - ethyl - 3 - methylbut - 3 - ene

81. Calculate the radius of an atom of metal if it forms simple cubic unit cell with edge length 380 pm.

(A) 285.0 pm
(B) 67.2 pm
(C) 190.0 pm
(D) 82.3 pm

82. Identify dispersed phase and dispersion medium in cheese.

	Dispersed Phase	**Dispersion medium**
1	liquid	solid
2	liquid	liquid
3	solid	liquid
4	solid	solid

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

83. How many moles of carbon atoms are present in 3.6 kg of carbon?

(A) 3.0×10^2 mole
(B) 1.8×10^2 mole
(C) 2.4×10^2 mole
(D) 4.8×10^2 mole

84. Calculate enthalpy change for following reaction.

$$H_2C = CH_{2(g)} + H_{2(g)} \longrightarrow H_3C - CH_{3(g)}$$

[The bond energy of $C - H, C - C, C = C$ and $H - H$ is $414, 347, 615$ and 435 kJ respectively]

(A) 125 kJ
(B) -125 kJ
(C) 250 kJ
(D) -250 kJ

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

Ethylphenyl ketone $\xrightarrow{H_2N-NH_2}$ A $\xrightarrow[\Delta]{KOH, HO(CH_2)_2OH}$ B

(A) Phenylhydrazone
(B) Ethylbenzene
(C) n-propylbenzene
(D) Isopropylbenzene

86. Which from following is NOT a lanthonoid element?

(A) Pm
(B) Er
(C) Yb
(D) Hf

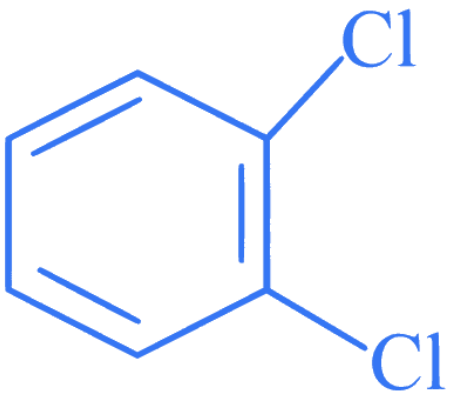
87. For the reaction, $A + 3B \longrightarrow 2C$ rate of consumption of A is 1.4 mol dm^{-3} sec^{-1}. Calculate rate of formation of C ?

(A) 0.07 mol dm^{-3} sec^{-1}
(B) 1.4 mol dm^{-3} sec^{-1}
(C) 2.8 mol dm^{-3} sec^{-1}
(D) 3.5 mol dm^{-3} sec^{-1}

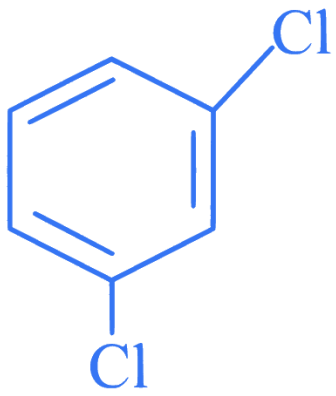
88. Identify the major product obtained in the following reaction.

Chlorobenzene $\xrightarrow[A \text{ Anhydrous } FFCl_3]{Cl_2}$ major product

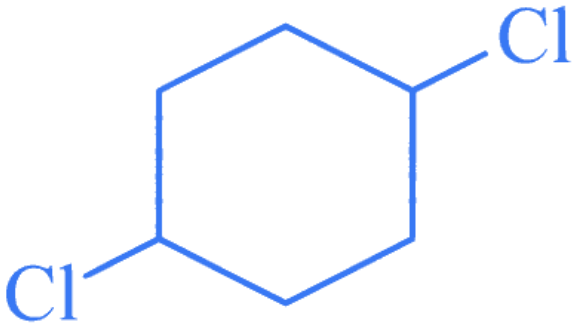
(A)



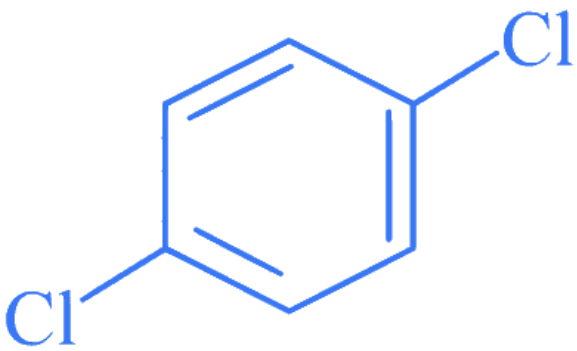
(B)



(C)



(D)



89. What is EAN of Cu in $[Cu(NH_3)_4]^{2+}$?

(A) 36 (B) 29

(C) 30 (D) 35

90. Calculate the number of unit cells in 10.8 g metal $(\varrho a^3 = 7.2 \times 10^{-22}\ g)$

(A) 1.5×10^{22} (B) 3.0×10^{22}

(C) 4.5×10^{22} (D) 6.0×10^{22}

91. Calculate van't Hoff factor of 0.2 m aquesous solution of an electrolyte if it freezes at -0.7 K $[K_f = 1.86\ K\ kg\ mol^{-1}]$

(A) 1.304 (B) 1.123

(C) 1.432 (D) 1.882

92. What is momentum of a microscopic particle having de Broglie's wavelength 6.0 A?

$(h = 6.63 \times 10^{-34} Js)$

(A) $4.6 \times 10^{-24}\ kg\ ms^{-1}$

(B) $1.1 \times 10^{-24}\ kg\ ms^{-1}$

(C) $3.18 \times 10^{-24}\ kg\ ms^{-1}$

(D) $6.36 \times 10^{-24}\ kg\ ms^{-1}$

93. Which from following species acts as base [1], according to Bronsted-Lowry theory?

$$HCl + NH_3 \rightleftharpoons NH_4^+ + Cl^-$$

(A) Cl^- (B) NH_3

(C) NH_4^+ (D) HCl

94. Which of the following reactions represents Clemmensen reduction?

(A) $R - \underset{\underset{O}{\|}}{C} - Cl \xrightarrow[Pd\text{-}BaSO_4]{H_2} R - CHO + HCl$

(B) $R - CN \xrightarrow[H_3O^+]{SnCl_2, HCl} R - CHO + NH_4Cl$

(C) $R - CHO \xrightarrow[\Delta]{Zn-Hg,\ conc\ HCl} R - CH_3 + H_2O$

(D) $R - CO - R \xrightarrow[(ii)\ KOH, \Delta HO - (CH_2)_2 - OH]{(i)\ H_2N - NH_2} R - CH_2 - R$

95. Which from following catalysts is used in the Haber's process for manufacture of ammonia?

(A) MnO_2 (B) Mo/Fe

(C) Co – Th (D) Fe – Cr

96. In a first order reaction if concentartion of reactant drops from 0.8 mol L^{-1} to 0.4 mol L^{-1} in 15 minute. What is the time required to drop concentration from 0.1 mol L^{-1} to 0.025 mol L^{-1}.

(A) 7.5 minute (B) 15 minute

(C) 30 minute (D) 60 minute

97. Calculate the quantity of electricity required to liberate 0.1 mole of chlorine gas during electrolysis of molten sodium chloride.

(A) 9665 C
(B) 19300 C
(C) 14500 C
(D) 96500 C

98. What is IUPAC name of $(CH_3)_4\,C$?

(A) Neopentane
(B) 2-Methylbutane
(C) 2-Methylpropane
(D) 2,2-Dimethylpropane

99. Find the total number of moles of donor atoms present in one mole trioxalatocobaltate(III) ion.

(A) 6
(B) 3
(C) 12
(D) 4

100. Calculate the molar mass of non volatile solute when 5 g of it is dissolved in 50 g solvent, boils at $119.6^{\circ}C$. $[K_b = 3.2\ K\ kg\ mol^{-1}$, boiling point of pure solvent $= 118^{\circ}C\ ]$.

(A) 180 g mol^{-1}
(B) 210 g mol^{-1}
(C) 200 g mol^{-1}
(D) 190 g mol^{-1}

101. Two tangents drawn from P$(1, 7)$ to the circle $x^2 + y^2 = 25$, touch the circle at Q and R respectively. The area of the quadrilateral PQOR is

(A) 16 sq. units (B) 36 sq. units
(C) 25 sq. units (D) 49 sq. units

102. Let $X = \begin{bmatrix} a \\ b \\ c \end{bmatrix}, A = \begin{bmatrix} 1 & -1 & 2 \\ 2 & 0 & 1 \\ 3 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 \\ 1 \\ 4 \end{bmatrix}$. If $AX = B$, then the value of $2a - 3b + 4c$ will be

(A) 0 (B) -4
(C) 6 (D) 4

103. Let in a Binomial distribution, consisting of 5 independent trials, probabilities of exactly 1 and 2 successes be 0.4096 and 0.2048 respectively. Then the probability of getting exactly 3 successes is equal to

(A) $\frac{80}{243}$ (B) $\frac{40}{7243}$
(C) $\frac{32}{625}$ (D) $\frac{128}{625}$

104. The unit vector which is orthogonal to the vector $5\hat{i} + 2\hat{j} + 6\hat{k}$ and is coplanar with the vectors $2\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} - \hat{j} + \hat{k}$ is

(A) $\frac{2\hat{i} - 6\hat{j} + \hat{k}}{\sqrt{41}}$ (B) $\frac{2\hat{i} - 5\hat{j}}{\sqrt{29}}$
(C) $\frac{-3\hat{j} + \hat{k}}{\sqrt{10}}$ (D) $\frac{2\hat{i} - 8\hat{j} + \hat{k}}{69}$

105. The probability distribution of a random variable X is given by

X $= x_i$:	**0**	**1**	**2**	**3**	**4**
P(X $= x_i$) :	0.4	0.3	0.1	0.1	0.1

Then the variance of X is

(A) 1.76 (B) 2.45
(C) 3.2 (D) 4.8

106. If $\int \frac{x+1}{\sqrt{2x-1}}\,dx = f(x)\sqrt{2x-1} + c$, (where c is a constant of integration), then $f(x)$ is equal to

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

107. If $\alpha + \beta + \gamma = \pi$, then the expression $\sin^2\alpha + \sin^2\beta - \sin^2\gamma$ has the value

(A) $2\sin\alpha\sin\beta\sin\gamma$ (B) $2\cos\alpha\sin\beta\sin\gamma$
(C) $2\sin\alpha\cos\beta\sin\gamma$ (D) $2\sin\alpha\sin\beta\cos\gamma$

108. Let $\overline{A} = 2\hat{i} + \hat{k}, \overline{B} = \hat{i} + \hat{j} + \hat{k}$ and $\overline{C} = 4\hat{i} - 3\hat{j} + 7\hat{k}$. If a vector $\bar{R}$ satisfies $\bar{R} \times \bar{B} = \bar{C} \times \bar{B}$ and $\bar{R} \cdot \overline{A} = 0$, then $\overline{R}$ is given by

(A) $\hat{i} - 8\hat{j} + 2\hat{k}$ (B) $\hat{i} + 8\hat{j} + 2\hat{k}$
(C) $-\hat{i} - 8\hat{j} + 2\hat{k}$ (D) $-\hat{i} - 8\hat{j} - 2\hat{k}$

109. Distance between the parallel lines $\frac{x}{3} = \frac{y-1}{-2} = \frac{z}{1}$ and $\frac{x+4}{3} = \frac{y-3}{-2} = \frac{z+2}{1}$ is

(A) $\sqrt{\frac{6}{7}}$ units (B) $\sqrt{\frac{3}{7}}$ units
(C) $\sqrt{\frac{3}{14}}$ units (D) $\sqrt{\frac{5}{14}}$ units

110. If $f(x) = \log_{x^2}(\log_e x)$, then $f'(x)$ at $x = e$ is

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

111. A body cools according to Newton's law of cooling from 100°C to 60°C in 15 minutes. If the temperature of the surrounding is 20°C, then the temperature of the body after cooling down for one hour is

(A) 30°C (B) 25°C
(C) 35°C (D) 40°C

112. The value of k , for which the function

$$f(x) = \begin{cases} \left(\frac{4}{5}\right)^{\frac{\ln 4x}{\tan 5x}}, & 0 < x < \frac{\pi}{2} \\ k + \frac{2}{5} & , x = \frac{\pi}{2} \end{cases}$$

is continuous at $x = \frac{\pi}{2}$, is

(A) $\frac{17}{20}$ (B) $\frac{3}{5}$
(C) $-\frac{2}{5}$ (D) $\frac{2}{5}$

113. The co-ordinates of a point on the curve $y = x\log x$ at which the normal is parallel to the line $2x - 2y = 3$ are

(A) $(-e^{-2}, 2e^{-2})$ (B) $(-e^{-2}, -2e^{-2})$
(C) $(e^{-2}, 2e^{-2})$ (D) $(e^{-2}, -2e^{-2})$

114. The value of $I = \int_{\sqrt{\log_e}}^{\sqrt{\log_e 3}} \frac{x \sin x^2}{\sin x^2 + \sin(\log_e 6 - x^2)} dx$ is

(A) $\frac{1}{4}\log_e \frac{3}{2}$ (B) $\frac{1}{2}\log_e \frac{3}{2}$

(C) $\log_e \frac{3}{2}$ (D) $\frac{1}{6}\log_e \frac{3}{2}$

115. The value of $I = \int \frac{dx}{x^2(x^4+1)^{\frac{3}{4}}}$ is

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

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

(C) $(1+\frac{1}{x^4})^{\frac{1}{4}} + c$, (where c is a constant of integration)

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

116. Three houses are available in a locality. Three persons apply for the houses. Each applies for one house without consulting others. The probability that all the three persons apply for the same house is

(A) $\frac{1}{9}$ (B) $\frac{2}{9}$

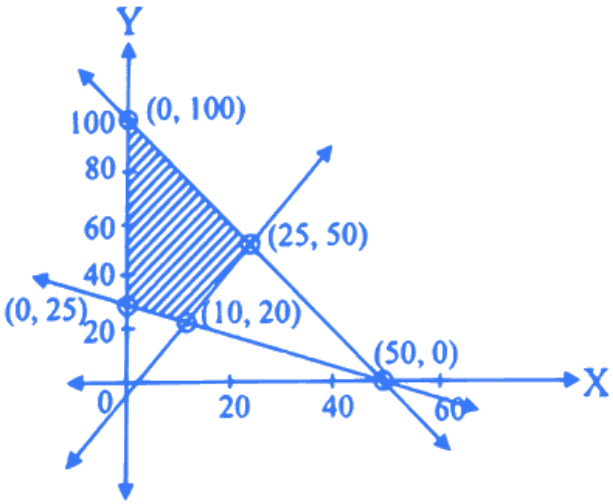
(C) $\frac{7}{9}$ (D) $\frac{8}{9}$

117. The value of C for which Mean value Theorem holds for the function $f(x) = \log_e x$ on the interval $[1, 3]$ is

(A) $\log_3 e$ (B) $\log_e 3$

(C) $\frac{1}{2}\log_c 3$ (D) $2\log_3 e$

118. The shaded region in the following figure is the solution set of the inequations



(A) $x + 2y \geq 50, 2x + y \leq 100, 2x - y \leq 0,\ x, y \geq 0$

(B) $x + 2y \leq 50, 2x + y \leq 100, 2x - y \leq 0,\ x, y \geq 0$

(C) $x + 2y \geq 50, 2x + y \geq 100, 2x - y \leq 0,\ x, y \geq 0$

(D) $x + 2y \leq 50, 2x + y \geq 100, 2x - y \leq 0,\ x, y \geq 0$

119. The diagonals of a parallelogram $ABCD$ are along the lines $x + 3y = 4$ and $6x - 2y = 7$. Then ABCD must be a

(A) rectangle (B) square

(C) rhombus (D) cyclic quadrilateral

120. If $x = \sec\theta - \cos\theta, y = \sec^{10}\theta - \cos^{10}\theta$ and $(x^2+4)\left(\frac{dy}{dx}\right)^2 = k(y^2+4)$, then the value of k is

(A) $\frac{1}{100}$ (B) 1

(C) 10 (D) 100

121. If $y = y(x)$ is the solution of the differential equation $\left(\frac{5+e^x}{2+y}\right)\frac{dy}{dx} + e^x = 0$ satisfying $y(0) = 1$, then a value of $y(\log 13)$ is

(A) -1 (B) 0

(C) 1 (D) 2

122. The equation of the plane, passing through the mid point of the line segment of join of the points $P(1, 2, 5)$ and $Q(3, 4, 3)$ and perpendicular to it, is

(A) $x + y - z + 1 = 0$ (B) $x + y - z - 1 = 0$

(C) $x + y + z + 1 = 0$ (D) $x - y - z + 1 = 0$

123. If C is a given non-zero scalar and $\overline{A}$ and $\overline{B}$ are given non-zero vectors such that $\overline{A}$ is perpendicular to $\overline{B}$. If vector $\overline{X}$ is such that $\overline{A} \cdot \overline{X} = C$ and $\overline{A} \times \overline{X} = \overline{B}$ then $\overline{X}$ is given by

(A) $\frac{C\overline{A}+\bar{A}\times\bar{B}}{|\bar{A}|^2}$ (B) $\frac{C\overline{A}\times\overline{B}}{|\bar{A}|^2}$

(C) $\frac{C\bar{A}-\bar{A}\times\bar{B}}{|\bar{A}|^2}$ (D) $\frac{C\overline{A}+\overline{B}}{|\bar{A}|^2}$

124. If the equation $7x^2 - 14xy + py^2 - 12x + qy - 4 = 0$ represents a pair of parallel lines then the value of $\sqrt{p^2 + q^2 - pq}$ is

(A) $\sqrt{119}$ (B) $\sqrt{107}$

(C) $\sqrt{109}$ (D) $\sqrt{108}$

125. If $P(x, y)$ denotes $z = x + iyx, y \in \mathbb{R}$ and $i = \sqrt{-1}$ in Argand's plane and $\left|\frac{z-1}{z+2i}\right| = 1$, then the locus of P is

(A) parabola (B) hyperbola

(C) circle (D) straight line

126. The general solution of $2\sqrt{3}\cos^2\theta = \sin\theta$ is

(A) $n\pi + (-1)^n \frac{\pi}{3}, n \in \mathbb{Z}$

(B) $n\pi + (-1)^n \frac{\pi}{6}, n \in \mathbb{Z}$

(C) $n\pi \pm (-1)^n \frac{\pi}{4}, n \in \mathbb{Z}$

(D) $n\pi + (-1)^n \frac{2\pi}{3}, n \in \mathbb{Z}$

127. If $(2 + \sin x)\frac{dy}{dx} + (y + 1)\cos x = 0$ and $y(0) = 1$ then $y\left(\frac{\pi}{2}\right)$ is equal to

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

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

128. The area of the triangle, whose vertices are $A \equiv (1, -1, 2), B \equiv (2, 1, -1)$ and $C \equiv (3, -1, 2)$, is

(A) $2\sqrt{3}$ sq.units (B) $4\sqrt{13}$ sq.units

(C) $\sqrt{13}$ sq.units (D) $4\sqrt{3}$ sq.units

129. The maximum value of the function $f(x) = 3x^3 - 18x^2 + 27x - 40$ on the set $S = \{x \in \mathbb{R}/x^2 + 30 \leq 11x\}$ is

(A) -122 (B) -222

(C) 222 (D) 122

130. $\tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right) + \tan\left(\frac{\pi}{4} - \frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right)$ is

(A) $\frac{2a}{b}$ (B) $\frac{2b}{a}$

(C) $\frac{a}{b}$ (D) $\frac{b}{a}$

131. Consider three observations a, b and c such that $b = a + c$. If the standard deviation of $a + 2$, $b + 2, c + 2$ is d , then ..... holds.

(A) $b^2 = 3(a^2 + c^2 + d^2)$

(B) $b^2 = a^2 + c^2 + 3d^2$

(C) $b^2 = 3(a^2 + c^2) - 9d^2$

(D) $b^2 = 3(a^2 + c^2) + 9d^2$

132. 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) 36 (B) 18

(C) $\frac{27}{4}$ (D) 9

133. If the lengths of the sides of triangle are 3,5,7, then the largest angle of the triangle is

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

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

134. If $f(x) = \sin^{-1}\left(\frac{2\cdot 3^x}{1+9^x}\right)$, then $f'\left(\frac{1}{2}\right)$ equals

(A) $\sqrt{3}\log(\sqrt{3})$ (B) $-\sqrt{3}\log 3$

(C) $-\sqrt{3}\log(\sqrt{3})$ (D) $\sqrt{3}\log 3$

135. $\int (f(x)g''(x) - f''(x)g(x))\,dx$ is equal to

(A) $f(x)g(x) - f'(x)g'(x)$

(B) $f'(x)g(x) - f(x)g'(x)$

(C) $f(x)g'(x) - f'(x)g(x)$

(D) $f(x)g'(x) + f'(x)g(x)$

136. The value of $\tan\left(2\tan^{-1}\left(\frac{\sqrt{5}-1}{2}\right)\right)$ is

(A) $2\sqrt{5}$ (B) 4

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

137. Number of different nine digit numbers, that can be formed from the digits in the number 223355888 by rearranging its digits, so that the odd digits occupy even positions, is

(A) 16 (B) 40

(C) 60 (D) 180

138. If $\bar{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\bar{b} = \hat{i} \times (\bar{a} \times \hat{i}) + \hat{j} \times (\bar{a} \times \hat{j}) + \hat{k} \times (\bar{a} \times \hat{k})$ then $|\bar{b}|$ is

(A) $\sqrt{12}$ (B) $2\sqrt{12}$

(C) $3\sqrt{14}$ (D) $2\sqrt{14}$

139. The equation of normal to the curve $x = \theta + \sin\theta, y = 1 + \cos\theta$ at $\theta = \frac{\pi}{2}$ is

(A) $2x + 2y - \pi = 0$ (B) $2x - y - \pi = 0$

(C) $2x - 2y - \pi = 0$ (D) $2x + y - \pi = 0$

140. The equation of the line, through $A(1, 2, 3)$ and perpendicular to the vector $2\hat{i} + \hat{j} - \hat{k}$ and $\hat{i} + 3\hat{j} + 2\hat{k}$, is

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

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

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

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

141. $\int \frac{\log\sqrt{x}}{3x} dx$ is equal to

(A) $\frac{1}{3}(\log\sqrt{x}) + c$, (where c is a constant of integration)

(B) $\frac{2}{3}(\log\sqrt{x})^2 + c$, (where c is a constant of integration)

(C) $\frac{2}{3}(\log x)^2 + c$, (where c is a constant of integration)

(D) $\frac{1}{12}(\log x)^2 + c$, (where c is a constant of integration)

142. The negation of contrapositive of the statement $p \to (\sim q \wedge r)$ is

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

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

143. If $F(x) = \left(f\left(\frac{x}{2}\right)\right)^2 + \left(g\left(\frac{x}{2}\right)\right)^2$, where $f''(x) = -f(x)$ and $g(x) = f'(x)$ and given by $F(5) = 5$, then $F(10)$ is equal to

(A) 5 (B) 10

(C) 15 (D) 0

144. Let P be the image of the point $(3, 1, 7)$ with respect to the plane $x - y + z = 3$. Then the equation of the plane passing through P and containing the straight line $\frac{x}{1} = \frac{y}{2} = \frac{z}{1}$ is

(A) $-4y - x + 7z = 0$ (B) $x - 4y - 7z = 0$

(C) $x - 4y + 7z = 0$ (D) $x + 4y + 7z = 0$

145. Let $f(\theta) = \sin\left(\tan^{-1}\left(\frac{\sin\theta}{\sqrt{\cos 2\theta}}\right)\right)$, where $\frac{-\pi}{4} < \theta < \frac{\pi}{4}$, then the value of $\frac{d}{d(\tan\theta)}(f(\theta))$ is

(A) -1 (B) 1

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

146. The approximate value of $\sqrt[3]{0.026}$ is

(A) 0.2762 (B) 0.2632

(C) 0.2963 (D) 0.2692

147. The incentre of the triangle whose vertices are $P(0, 3, 0), Q(0, 0, 4)$ and $R(0, 3, 4)$ is

(A) $(0, 3, 2)$ (B) $(0, 2, 3)$

(C) $(2, 0, 3)$ (D) $(2, 3, 0)$

148. A random variable X has the following probability distribution

X $= x_i$:	1	2	3	4
P(X=x_i) :	0.2	0.4	0.3	0.1

The mean and variance of X are respectively

(A) 2.3 and 6.1 (B) 2.3 and 0.1

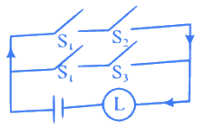
(C) 2.3 and 0.81 (D) 2.3 and 0.9

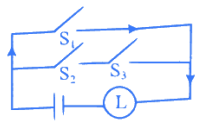
149. $\lim_{x \to 0} \frac{\sin(\pi\cos^2 x)}{x^2}$ is equal to

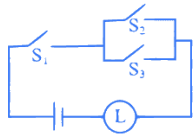
(A) 1 (B) $-\pi$

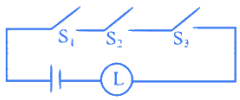
(C) π (D) $\frac{\pi}{2}$

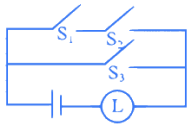
150. Which one of the following is the pair of equivalent circuits?

i. 

ii. 

iii. 

iv. 

v. 

(A) (i) and (ii) (B) (ii) and (iv)

(C) (iii) and (v) (D) (i) and (iii)

- End of Question Paper -