MHT CET 2024 PCM May 3 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 gas expands in such a way that its pressure and volume satisfy the condition $PV^2 =$ constant. Then the temperature of the gas

(A) will decrease.
(B) will increase.
(C) will not change.
(D) may increase or decrease depending upon the values of pressure and volume.

2. A thin ring of radius ' R ' carries a uniformly distributed charge. The ring rotates at constant speed ' N ' r.p.s. about its axis perpendicular to the plane. If ' B ' is the magnetic field at the centre, the charge on the ring is ($\mu_0 =$ permeability of free space)

(A) $\frac{\mu_0 \mathrm{N}}{2\mathrm{RB}}$
(B) $\frac{RB}{2\mu_0 \mathrm{N}}$
(C) $\frac{\mu_0 N}{RB}$
(D) $\frac{2RB}{\mu_0 \mathrm{N}}$

3. The r.m.s. velocity of gas molecules kept at temperature 27°C in a vessel is 61 m/s. Molecular weight of gas is nearly

$$\left[\mathrm{R} = 8.31 \frac{\mathrm{J}}{\mathrm{mol\ K}}\right]$$

(A) 2
(B) 4
(C) 28
(D) 32

4. A regular hexagon of side 10 cm has a charge 1μC at each of its vertices. The potential at the centre of hexagon is $\left[\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ SI unit}\right]$

(A) 1.8×10^5 volt
(B) 3.6×10^5 volt
(C) 5.4×10^5 volt
(D) 7.2×10^5 volt

5. A wheel of radius 1 m rolls through 180° over a plane surface. The magnitude of the displacement of the point of the wheel initially in contact with the surface is.

(A) 2π
(B) π
(C) $\sqrt{\pi^2 + 4}$
(D) 3π

6. The end correction of resonance tube is 1 cm. If the shortest length resonating with a tuning fork is 15 cm , the next resonating length will be

(A) 35 cm
(B) 40 cm
(C) 47 cm
(D) 64 cm

7. When 80 volt d.c. is applied across a solenoid, a current of 0.8 A flows in it. When 80 volt a.c. is applied across the same solenoid, the current becomes 0.4 A . If the frequency of a.c. source is 50 Hz , the impedance and inductance of the solenoid is nearly

(A) $200\Omega, 0.55\mathrm{H}$
(B) $100\Omega, 0.8\mathrm{H}$
(C) $300\Omega, 1.2\mathrm{H}$
(D) $200\Omega, 1.5\mathrm{H}$

8. The earth is assumed to be a sphere of radius ' R ' and mass ' M ' having period of rotation ' T '. The angular momentum of earth about its axis of rotation is

(A) $\frac{2\pi \mathrm{MR}^2}{5\ \mathrm{T}}$
(B) $\frac{4\pi \mathrm{MR}^2}{5\ \mathrm{T}}$
(C) $\frac{\mathrm{MR}^2\ \mathrm{T}}{2\pi}$
(D) $\frac{\mathrm{MR}^2\ \mathrm{T}}{4\pi}$

9. When a galvanometer is shunted by a resistance ' S ', its current capacity increases ' n ' times. If the same galvanometer is shunted by another resistance S′, its current capacity increases to n′. The value of n' in terms of n, S and S' is

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

10. In projectile motion two particles of masses m_1 and m_2 have velocities $\vec{V}_1$, and $\vec{V}_2$ respectively at time $t = 0$. Their velocities become $\overrightarrow{V_1'}$ and $\overrightarrow{V_2'}$ at time 2 t while still moving in air. The value of $\left[\left(m_1\overrightarrow{V_1'} + m_2\overrightarrow{V_2'}\right) - \left(m_1\vec{V}_1 + m_2\vec{V}_2\right)\right]$ is (g = acceleration due to gravity)

(A) zero
(B) $\frac{1}{2}(\mathrm{m}_1 + \mathrm{m}_2)\mathrm{gt}$
(C) $(m_1 + m_2)gt$
(D) $2(m_1 + m_2)gt$

11. The magnetic susceptibility of the material of a rod is 599. The absolute permeability of the material of the rod will be [$\mu_0 = 4\pi \times 10^{-7}$ SI unit]

(A) $2\pi \times 10^{-4}$
(B) $2.4\pi \times 10^{-4}$
(C) $4\pi \times 10^{-4}$
(D) $4.8\pi \times 10^{-4}$

12. If ' l ' is the length of pipe, ' r ' is the internal radius of the pipe and ' v ' is the velocity of sound in air then fundamental frequency of open pipe is

(A) $\frac{\mathrm{V}}{2(l+1\cdot2\mathrm{r})}$
(B) $\frac{\mathrm{V}}{(l+1\cdot2\mathrm{r})}$
(C) $\frac{\mathrm{V}}{(l+0.3\mathrm{r})}$
(D) $\frac{\mathrm{V}}{(l+0\cdot6\mathrm{r})}$

13. A charged particle is moving along a magnetic field line. What is the magnetic force acting on the particle? $\left(\sin 0^{\circ}=0, \sin \frac{\pi}{2}=1\right)$

(A) Opposite to its velocity.
(B) Perpendicular to its velocity.
(C) Zero.
(D) Along its velocity.

14. A diatomic gas undergoes adiabatic change. Its pressure P and temperature T are related as $P \propto T^{x}$ where the value of x is

(A) 3.5
(B) 2.5
(C) 4.5
(D) 3

15. The height at which the weight of the body becomes $\frac{1^{\text{th}}}{16}$ of its weight on the surface of the earth of radius ' R ' is

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

16. A transformer is used to set up an alternating e.m.f. of 220 V to 4.4 kV to transmit 6.6 kW of power. The primary coil has 1000 turns. The current rating of the secondary coil is (Transformer is ideal)

(A) 0.8 A
(B) 1.2 A
(C) 1.5 A
(D) 1.8 A

17. A monoatomic gas is heated at constant pressure. The percentage of total heat used for doing external work is

(A) 30%
(B) 40%
(C) 50%
(D) 60%

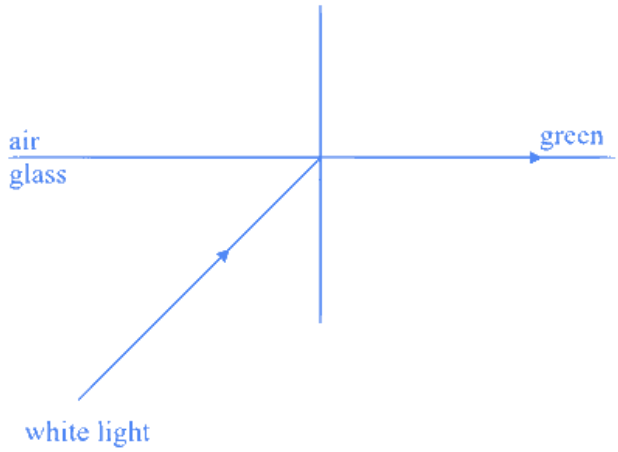
18. A parallel plate capacitor is charged and then isolated. If the separation between the plates is increased, which one of the following statement is NOT correct?

(A) Charge remains constant after it is isolated.
(B) Potential difference across the plates decreases.
(C) Potential difference across the plates increases.
(D) Capacitance of capacitor decreases.

19. The ratio of the radius of the first Bohr orbit to that of the second Bohr orbit of the orbital electron is

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

20. White light is incident on the interface of glass and air as shown in figure. If green light is just totally internally reflected, then reflected rays inside the glass contain



(A) yellow, orange, red
(B) violet, indigo, blue
(C) green, yellow, orange
(D) all colours except green

21. Two loops ' A ' and ' B ' of radii ' R_1 ' and ' R_2 ' are made from uniform wire. If moment of inertia of ' A ' is ' I_A ' and that ' B ' is ' I_B ', then R_2/R_1 is $\left[\frac{I_A}{I_B}=27\right]$

(A) 1 : 6
(B) 1 : 4
(C) 1 : 3
(D) 1 : 2

22. A series LCR circuit containing a resistance ' R ' has angular frequency ' ω '. At resonance the voltage across resistance and inductor are ' V_R ' and ' V_L ' respectively, then value of inductance ' L ' will be

(A) $\frac{V_R R}{V_L \omega}$
(B) $\frac{V_L}{V_R R \omega}$
(C) $\frac{V_R \omega}{V_L R}$
(D) $\frac{V_L R}{V_R \omega}$

23. The period of a simple pendulum gets doubled when

(A) its length is doubled.
(B) its length is made four times.
(C) its length is made half.
(D) the mass of the bob is doubled.

24. The Boolean expression for ' $x-OR$ ' gate $C=(A \oplus B)$ is equal to

(A) $(A \cdot B)+(\bar{A} \cdot \bar{B})$
(B) $A+(\bar{A} \cdot \bar{B})$
(C) $(A \cdot B)+\bar{B}$
(D) $(\bar{A} \cdot B)+(A \cdot \bar{B})$

25. Two identical metal spheres are kept in contact with each other, each having radius ' R ' cm and ' ρ ' is the density of material of metal spheres. The gravitational force ' F ' of attraction between them is proportional to

(A) $R^3\rho$ (B) $R^4\rho^2$

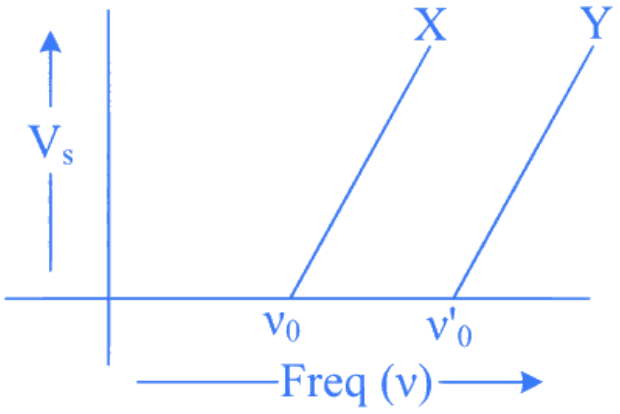
(C) $R^4\rho$ (D) R^3p^2

26. A violin emits sound waves of frequency ' n_1 ' under tension T. When tension is increased by 44%, keeping the length and mass per unit length constant, frequency of sound waves becomes ' n_2 '. The ratio of frequency ' n_2 ' to frequency ' n_1 ' is

(A) 5 : 6 (B) 6 : 7

(C) 6 : 5 (D) 7 : 6

27. The graph of stopping potential ' V_s ' against frequency ' v ' of incident radiation is plotted for two different metals ' X ' and ' Y ' as shown in graph. ' ϕ_x ' and ' ϕ_y ' are work functions of ' x ' and ' Y ' respectively then



(A) $\varrho_x = \varrho_y$ (B) $\varrho_x < \varrho_y$

(C) $\varrho_x > \varrho_y$ (D) $\varrho_x = \varrho_y = 0$

28. A steel ball of radius 6 mm has a terminal speed of 12cms^{-1} in a viscous liquid. What will be the terminal speed of a steel ball of radius 3 mm in the same liquid?

(A) 12 cms^{-1} (B) 9 cms^{-1}

(C) 6 cms^{-1} (D) 3 cms^{-1}

29. Two coils are kept near each other. When no current passess through first coil and current in the 2^{nd} coil increases at the rate 10 A/s, the e.m.f. in the $1^{\mathbb{P}}$ coil is 20 mV . When no current passes through 2^{nd} coil and 3.6 A current passes through 1^2 coil the flux linkage in coil 2 is

(A) 1.2×10^{-3} Wb (B) 1.8×10^{-3} Wb

(C) 3.6×10^{-3} Wb (D) 7.2×10^{-3} Wb

30. Two rods, one of copper (Cu) and the other of iron (Fe) having initial lengths L_1 and L_2 respectively are connected together to form a single rod of length $L_1 + L_2$. The coefficient of linear expansion of Cu and Fe are α_c and α_i respectively. If the length of each rod increases by the same amount when their temperatures are raised by t°C, then ratio of $\frac{L_1-L_2}{L_1+L_2}$ will be

(A) $\frac{\alpha_i}{\alpha_c+\alpha_i}$ (B) $\frac{\alpha_c}{\alpha_c+\alpha_i}$

(C) $\frac{\alpha_i-\alpha_c}{\alpha_c+\alpha_i}$ (D) $\frac{\alpha_c-\alpha_i}{\alpha_c+\alpha_i}$

31. Frequency of a particle performing S.H.M. is 10 Hz . The particle is suspended from a vertical spring. At the highest point of its oscillation the spring is unstretched. Maximum speed of the particle is $\left(g = 10\ \text{m/s}^2\right)$

(A) $\frac{1}{\pi}$ m/s (B) $\frac{1}{2\pi}$ m/s

(C) $\frac{1}{4\pi}$ m/s (D) 2π m/s

32. Two charged particles each having charge ' q ' and mass ' m ' are held at rest while their separation is ' r '. The speed of the particles when their separation is ' $\frac{r}{2}$ ' will be (ε_0 = permittivity of the medium)

(A) $\frac{q}{4\pi\epsilon_0 mr}$ (B) $\frac{q}{2\pi\epsilon_0 mr}$

(C) $\frac{q}{\sqrt{4\pi\epsilon_0 mr}}$ (D) $\frac{q^2}{4\pi\epsilon_0 mr}$

33. The pressure inside a soap bubble A is 1.01 atmosphere and that in a soap bubble B is 1.02 atmosphere. The ratio of volume of bubble A to that of B is [Surrounding pressure = 1 atmosphere]

(A) 101 : 102 (B) 102 : 101

(C) 8 : 1 (D) 2 : 1

34. In Young's double slit experiment, in an interference pattern, second minimum is observed exactly in front of one slit. The distance between the two coherent sources is ' d ' and the distance between the source and screen is ' D '. The wave length of light (λ) used is

(A) $\frac{d^2}{D}$ (B) $\frac{d^2}{2D}$
(C) $\frac{d^2}{3D}$ (D) $\frac{d^2}{4D}$

35. An observer moves towards a stationary source of sound with a velocity of one-fifth of the velocity of sound. The percentage increase in the apparent frequency is

(A) 5% (B) 10%
(C) 20% (D) 25%

36. A diatomic molecule has moment of inertia ' I ', By applying Bohr's quantization condition, its rotational energy in the n^{th} level is $[n \geq 1]$ [h= Planck's constant]

(A) $\frac{1}{n^2}(\frac{h^2}{8\pi^2 I})$ (B) $\frac{1}{n}(\frac{h^2}{8\pi^2 I})$
(C) $n(\frac{h^2}{8\pi^2 I})$ (D) $n^2(\frac{h^2}{8\pi^2 I})$

37. The frequency of incident light falling on a photosensitive material is doubled, the K.E. of the emitted photoelectrons will be

(A) unchanged. (B) two times its initial value.
(C) more than two times its initial value. (D) less than two times its initial value.

38. A screen is placed at 50 cm from a single slit, which is illuminated with light of wavelength 600 nm . If separation between the 1^{st} and 3^{rd} minima in the diffraction pattern is 3 mm then slit width is

(A) 0.2 mm (B) 0.02 mm
(C) 2 mm (D) 20 mm

39. A rod of length ' l ' is rotated with angular velocity ' ω ' about its one end, perpendicular to a magnetic field of induction ' B '. The e.m.f. induced in the rod is

(A) $Bl^2\omega$ (B) $0.5\ Bl^2\omega$
(C) B/ω (D) $0.5\ B/\omega$

40. A convex lens of focal length ' f ' produces a real image whose size is ' n ' times the size of an object. The distance of the object from the lens is

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

41. A liquid drop of density ' ρ ' is floating half immersed in a liquid of density ' d '. If ' T ' is the surface tension then the diameter of the liquid drop is (g = acceleration due to gravity)

(A) $[\frac{6\ T}{g(2\rho-d)}]^{\frac{1}{2}}$ (B) $[\frac{8\ T}{3\ g(2\rho-d)}]^{\frac{1}{2}}$
(C) $[\frac{12\ T}{g(2\rho-d)}]^{\frac{1}{2}}$ (D) $[\frac{3T}{g(2\rho-d)}]^{\frac{1}{2}}$

42. When the electron orbiting in hydrogen atom in its ground state moves to the third excited state, the de-Broglie wavelength associated with it

(A) becomes zero. (B) remains unchanged.
(C) will decrease. (D) will increase.

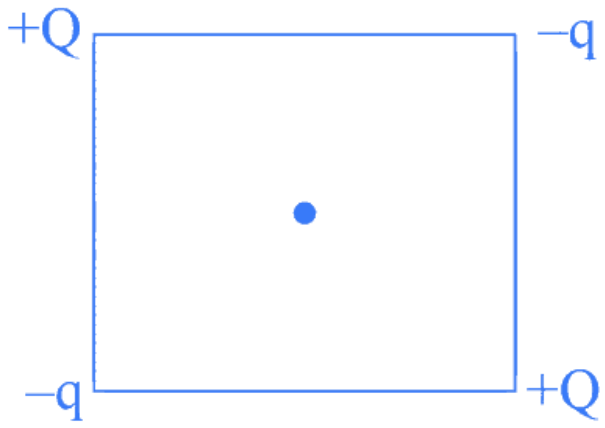
43. When a particle in linear S.H.M. completes two oscillations, its phase increases by

(A) π rad. (B) 2π rad.
(C) 3π rad. (D) 4π rad.

44. Resistances in the left gap and right gap of a meter bridge are 10Ω and 30Ω respectively. If the resistances in the two gaps are interchanged, the balance point will shift to right by

(A) 30 cm (B) 40 cm
(C) 50 cm (D) 60 cm

45. A charge $+Q$ is placed at each of the diagonally opposite corners of a square. A charge -q is placed at each of the other diagonally opposite corners as shown. If the net electrical force on $+Q$ is zero, then $\frac{+Q}{-q}$ is equal to



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

46. A 42 mH inductor is connected to 200 V, 50 Hz a.c. supply. The r.m.s. value of current in the circuit will be nearly [Take $\pi = \frac{22}{7}$]

(A) 15.15 A
(B) 9.15 A
(C) 8.15 A
(D) 6.15 A

47. In Young's double slit experiment using monochromatic light of wavelength ' λ ', the intensity of light at a point on the screen where path difference ' λ ' is K units. The intensity of light at a point where the path difference is $\frac{\lambda}{6}$ is $\left[\cos\frac{\pi}{6} = \sin\frac{\pi}{3} = \frac{\sqrt{3}}{2}\right]$

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

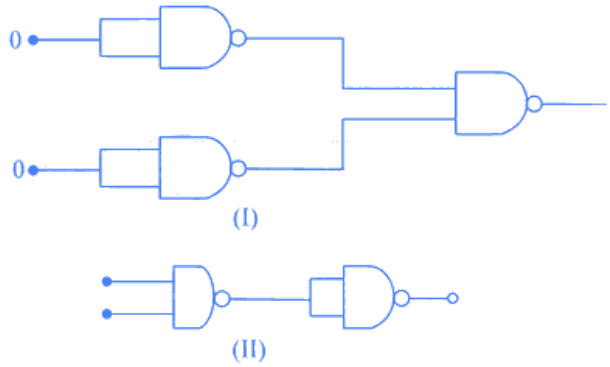
48. Which one of the following statements is true? A p-type semiconductor is doped with

(A) trivalent impurity and electrons are majority carriers.
(B) pentavalent impurity and electrons are minority carriers.
(C) pentavalent impurity and holes are minority carriers.
(D) trivalent impurity and holes are majority carriers.

49. The specific heat of argon at constant pressure and constant volume are C_p and C_v respectively. It's density ' ρ ' at N.T.P. will be [P and T are pressure and temperature respectively at N.T.P.]

(A) $\frac{P}{T(C_p - C_v)}$
(B) $\frac{PT}{(C_p - C_v)}$
(C) $\frac{T(C_p - C_v)}{P}$
(D) $\frac{(C_p - C_v)}{PT}$

50. The combination of NAND gates is shown in figure (I) and (II). For the given inputs, the outputs in both the combinations are respectively.



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

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51. The molal elevation boiling point constant for water is $0.513^{\circ}CKgmol^{-1}$. Calculate boiling point of solution if 0.1 mole of sugar is dissolved in 200 g water?

(A) $100.513^{\circ}C$ (B) $100.256^{\circ}C$

(C) $100.0513^{\circ}C$ (D) $100.025^{\circ}C$

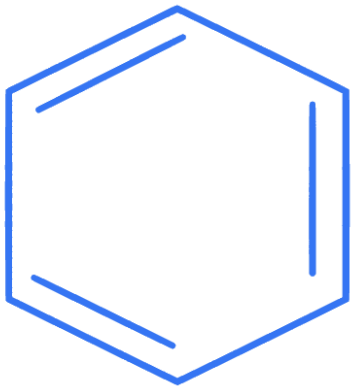
52. Which of the following does not react with cold or hot water?

(A) Ba (B) Ca

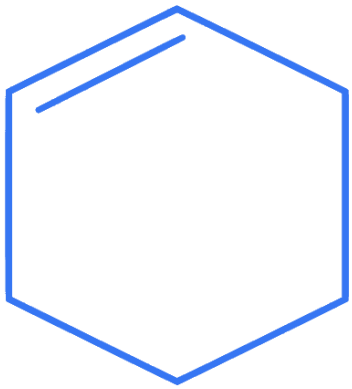
(C) Sr (D) Be

53. Identify the product obtained when phenol of heated with Zn dust.

(A)

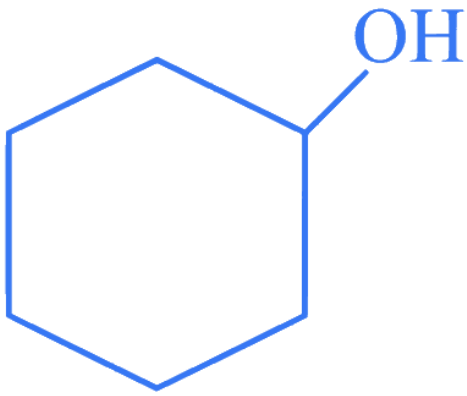


(B)



(C) $3CH \equiv CH$

(D)



54. For a zero order reaction $A \longrightarrow$ product. Conc. of A decreases from $0.8\ mol\ dm^{-3}$ to $0.2\ mol\ dm^{-3}$ in 6 minute. What is rate constant of the reaction?

(A) $0.01\ mol\ dm^{-3}\ minute^{-1}$ (B) $1.0\ mol\ dm^{-3}\ minute^{-1}$

(C) $0.1\ mol\ dm^{-3}\ minute^{-1}$ (D) $1.66\ mol\ dm^{-3}\ minute^{-1}$

55. Find value of Q from following equations.
(i) $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)} \Delta H = QkJ$
(ii) $C_{(s)} + \frac{1}{2}O_{2(8)} \longrightarrow CO_{2(8)} \Delta H = -xkJ$
(iii) $C_{(s)} + \frac{1}{2}O_{2(s)} \longrightarrow CO_{2(g)} \Delta H = -ykJ$

(A) $-(x+y)kJ$ (B) $(x-y)kJ$
(C) $\frac{-x+y}{2}$ kJ (D) $\frac{x+y}{2}$ kJ

56. "A given compound always contains the same proportion of elements" is a statement of -

(A) Law of combining volumes of gases (B) Law of conservation of mass
(C) Law of multiple proportions (D) Law of definite proportions

57. Identify the correct decreasing order of thermal stability from following.

(A) ClF > ICl > Br > BrCl
(B) BrCl > Br > ICl > ClF
(C) ClF > Br > BrCl > ICl
(D) ClF > BrCl > Br > ClF

58. What is the number of moles of N atoms and number of moles of O atoms respectively present in one mole of uracil?

(A) 1 and 5 (B) 1 and 3
(C) 2 and 3 (D) 2 and 2

59. Which from following molecules exhibits lowest dipole moment?

(A) CH_3F (B) CH_3Cl
(C) CH_3Br (D) CH_3I

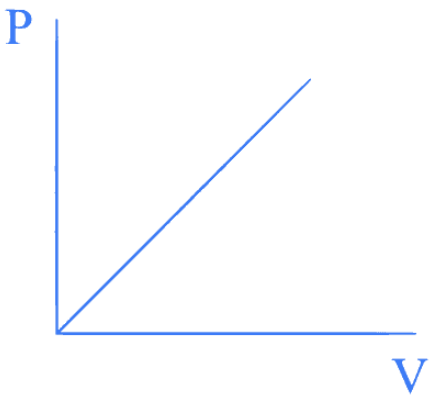
60. Identify the number of moles of ethene obtained when n moles of N, N, N-triethylpropylammonium iodide is treated with moist Ag_2O and then heated.

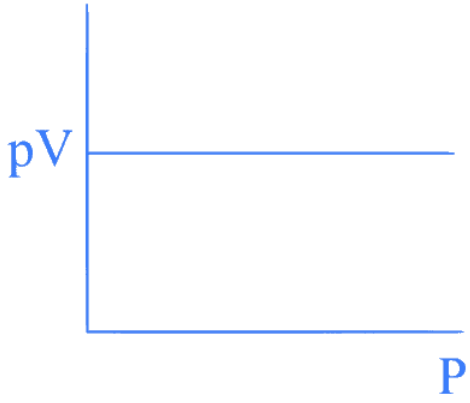
(A) n (B) 2n
(C) 3n (D) 4n

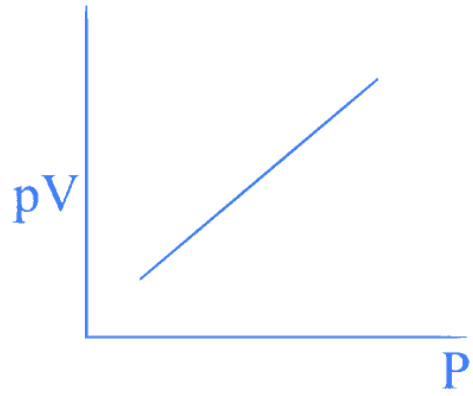
61. What mass of solute (molar mass 58 g mol^{-1}) is to be dissolved in 2.5 dm^3 H_2O to generate osmotic pressure of 0.245 atm at 300 K ?
$\left(R = 0.0821\ dm^3\ atm\ K^{-1}\ mol^{-1}\right)$

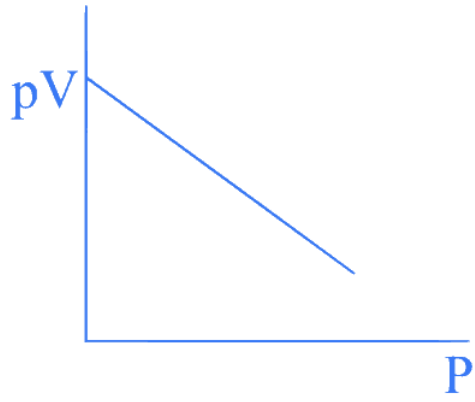
(A) 1.0 gram (B) 0.72 gram
(C) 1.44 gram (D) 1.75 gram

62. Which of the following graphs explains Boyle's law?

(A)


(B)


(C)


(D)


63. Identify the compound having highest solubility in water from following?

(A) Phenol (B) tert-Butyl alcohol
(C) o-Nitrophenol (D) p-Nitrophenol

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64. What is rate constant of a first order reaction if 60% reactant decompose in 45 minute?

(A) 0.010 minute $^{-1}$ (B) 0.015 minute $^{-1}$

(C) 0.020 minute $^{-1}$ (D) 0.025 minute $^{-1}$

65. What is the product obtained when benzonitrile is treated with C_6H_5MgBr in dry ether and then hydrolyzed?

(A) Phenol (B) Benzophenone

(C) Benzyl amine (D) Benzene

66. Which of the following compounds is amphoteric in nature?

(A) HCl (B) H_2O

(C) CH_3COOH (D) NaOH

67. What is the energy associated with first orbit of He^+?

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

(C) -6.54×10^{-18} J (D) -8.72×10^{-18} J

68. What is the number of lone pair of electrons involved in IF molecule?

(A) 3 (B) 2

(C) 1 (D) Zero

69. Which ' c ' atom of ribose sugar (numbered from $1'$ to $5'$) bonds with phosphate group to form AMP?

(A) $1'$ (B) $3'$

(C) $4'$ (D) $5'$

70. Which from following ligands is able to form linkage isomers?

(A) SCN (B) H_2O

(C) CN^- (D) $C_2O_4^{2-}$

71. What is the formula of Hinsberg's reagent?

(A) $C_6H_5SOCl_2$ (B) $C_2H_5SO_2Cl$

(C) $C_6H_5SO_2Cl$ (D) $C_2H_5CrOCl_2$

72. Which from the following statements is NOT true regarding crystalline solid?

(A) There is a regularity and periodicity in arrangement of constituent particles. (B) It is isotropic.

(C) It melts at definite temperature. (D) It has different magnitudes for refractive index in every direction.

73. Which is NOT an example of macromolecular colloid?

(A) Protein (B) Polythene

(C) Nylon (D) Soap

74. What type of product is obtained when formaldehyde reacts with CH_3MgBr in dry ether?

(A) Primary alcohol with same number of carbon atoms as in aldehyde. (B) Primary alcohol with one carbon atom more than aldehyde.

(C) Secondary alcohol with one carbon atom more than aldehyde. (D) Tertiary alcohol with two carbon atoms more than aldehyde.

75. Half life of a zero order reaction is directly proportional to _____

(A) temperature (B) rate constant

(C) amount of product formed (D) initial concentration of reactant

76. Calculate pH of 0.002 M KOH solution.

(A) 10.4 (B) 11.3

(C) 12.4 (D) 13.2

77. What is the wave number of lowest transition in Balmer series?

(A) $R_H(\frac{36}{5})$ (B) $R_H(\frac{5}{36})$

(C) $R_H(\frac{21}{100})$ (D) $R_H(\frac{100}{21})$

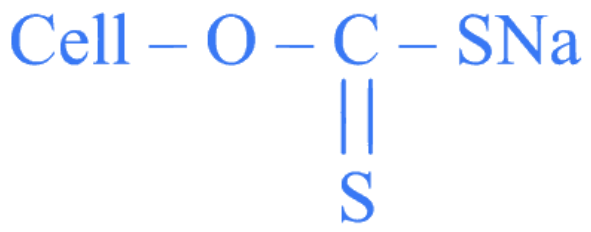
78. The limiting molar conductivities (Λ_0) for NaCl , KBr and KCl are 126,152 and 150 S cm^2 mol^{-1} respectively. What is the Λ_0 of NaBr ?

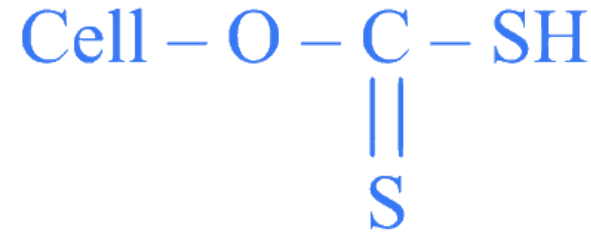
(A) 128 S cm^2 mol^{-1} (B) 302 S cm^2 mol^{-1}

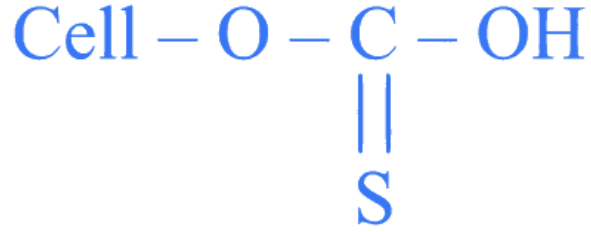
(C) 278 S cm^2 mol^{-1} (D) 176 S cm^2 mol^{-1}

79. If Cell – OH represents formula of cellulose, identify the formula of cellulose xanthate from following.

(A) Cell – ONa

(B) 

(C) 

(D) 

80. Which from following ligands has highest field strength?

(A) S^{--} (B) OH^{-}

(C) EDTA (D) en

81. Which from following compounds is NOT a mono carboxylic acid?

(A) Phthalic acid (B) Salicylic acid

(C) o-toluic acid (D) Benzoic acid

82. Find the void volume of bec unit cell in cm^3 if volume of unit cell is $1.5 \times 10^{-22}\ cm^3$.

(A) 4.8×10^{-23} (B) 3.6×10^{-23}

(C) 2.4×10^{-23} (D) 1.2×10^{-23}

83. Which from following carbocations is least stable?

(A) $(R)_3 - C^{+}$ (B) $(R)_2 - \overset{+}{C}H$

(C) $R - \overset{+}{C}H_2$ (D) $H_3\overset{+}{C}$

84. Identify compound Q in following reaction.

$$R - OH + Q \longrightarrow R - Cl + HCl + POCl_3$$

(A) HCl (B) PCl_3

(C) PCl_5 (D) $SOCl_2$

85. A conductivity cell dipped on 0.05 M KCl has resistance 600 ohm. If conductivity is $0.0015 ohm^{-1}\ cm^{-1}$. What is the value of cell constant?

(A) $0.47\ cm^{-1}$ (B) $0.90\ cm^{-1}$

(C) $1.5\ cm^{-1}$ (D) $2.5\ cm^{-1}$

86. Calculate ' α ' for 0.1 M acetic acid $\left(K_a = 1.0 \times 10^{-5}\right)$

(A) 10^{-2} (B) 10^{-3}

(C) 10^{-4} (D) 10^{-5}

87. Which of the following types of hybridisation result in trigonal geometry?

(A) sp (B) dsp^2

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

88. Which of the following statements is appropriate as per first law of thermodynamics?

(A) Energy of the system remains constant.

(B) Energy of the surrounding remains constant.

(C) Entropy of the universe remains constant.

(D) Energy of the universe remains constant.

89. Which from following is NOT true about natural rubber?

(A) It is formed by addition polymerization.

(B) It is a linear polymer.

(C) It has cis configuration of $C = C$.

(D) It contains butadine and styrene as monomer units.

90. Identify the element having smallest ionic size in +3 state from following.

(A) Nd (B) Sm

(C) Ho (D) Lu

91. Which from following is NOT a dicarboxylic acid?

(A) Citric acid (B) Oxalic acid

(C) Malonic acid (D) Glutaric acid

92. Calculate the volume of unit cell of an element having molar mass $63.5\ g\ mol^{-1}$ that forms fcc structure $\left[\varrho \times N_A = 5.5 \times 10^{24}\ g\ cm^{-3}\ mol^{-1}\right]$

(A) $4.102 \times 10^{-23}\ cm^3$ (B) $5.430 \times 10^{-23}\ cm^3$

(C) $5.014 \times 10^{-23}\ cm^3$ (D) $4.618 \times 10^{-23}\ cm^3$

93. Which from following has highest boiling point?

(A) 2-methoxy propane (B) n-butane

(C) 2-methylbutane (D) n-pentane

94. Which from following alkyl halides has highest boiling point?

(A) CH_3 F (B) CH_3Cl

(C) CH_3Br (D) CH_3I

95. What is the cell constant, if two platinum electrodes in conductivity cell are separated by 0.92 cm and area of cross section is 1.2 cm^2 ?

(A) 0.767 cm^{-1} (B) 0.906 cm^{-1}

(C) 1.304 cm^{-1} (D) 1.104 cm^{-1}

96. Which of the following equation correctly represents molar mass of a solute by knowing boiling point elevation?

(A) $M_2 = \frac{1000 \times \Delta T_b \times W_2}{K_b \times W_1}$ (B) $M_2 = \frac{1000 \times K_b \times W_1}{\Delta T_b \times W_2}$

(C) $M_2 = \frac{1000 \times \Delta T_b \times W_1}{K_b \times W_2}$ (D) $M_2 = \frac{1000 \times K_b \times W_2}{\Delta T_b \times W_1}$

97. In which of the following compounds chlorine has highest oxidation state?

(A) KCl (B) HClO

(C) $HClO_2$ (D) $HClO_4$

98. Given that

$$C_{(g)} + 4H_{(g)} \longrightarrow CH_{4(g)} \Delta H^\circ = -1665 \text{ kJ}$$

What is bond energy per mole of C – H bond?

(A) 416 kJ mol^{-1} (B) −416 kJ mol^{-1}

(C) 832.5 kJ mol^{-1} (D) −832.5 kJ mol^{-1}

99. What type of information is collected using FTIR fourier transform infrared spectroscopy?

(A) Morphology of nanomaterial (B) Absorption of functional group

(C) Geometry of particles (D) Particle size

100. Which from following lanthanoids exhibits no effective magnetic moment in +3 state?

(A) Ce (B) La

(C) Gd (D) Eu

101. The equation of the line passing through the point of intersection of the lines $3x - y = 5$ and $x + 3y = 1$ and making equal intercepts on the axes is

(A) $5x + 5y - 7 = 0$ (B) $5x - 5y - 7 = 0$

(C) $2x + y - 7 = 0$ (D) $x - y + 7 = 0$

102.

$$\int \frac{\text{cosec}\, x dx}{\cos^2\left(1 + \log\tan\frac{x}{2}\right)} =$$

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

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

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

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

103. The vectors $\bar{a}$ and $\bar{b}$ are not perpendicular and $\bar{c}$ and $\bar{d}$ are two vectors satisfying $\bar{b} \times \bar{c} = \bar{b} \times \bar{d}$ and $\bar{a} \cdot \bar{d} = 0$, then the vector $\bar{d}$ is equal to

(A) $\bar{b} + (\frac{\bar{b}\cdot\bar{c}}{\bar{a}\cdot\bar{b}})\bar{c}$ (B) $\bar{c} - (\frac{\bar{a}\cdot\bar{c}}{\bar{a}\cdot\bar{b}})\bar{b}$

(C) $\bar{b} - (\frac{\bar{b}\cdot\bar{c}}{\bar{a}\cdot\bar{b}})\bar{c}$ (D) $\bar{c} + (\frac{\bar{a}\cdot\bar{c}}{\bar{a}\cdot\bar{b}})\bar{b}$

104. If the function $f(x) = \left(\frac{5x-8}{8-3x}\right)^{\frac{3}{2x-4}}$ if $x \neq 2$. $= k$ if $x = 2$. is continuous at $x = 2$, then $k =$

(A) e^6 (B) e^2

(C) e^{-6} (D) e^{-2}

105. The domain of definition of $f(x) = \frac{\log_2(x+3)}{x^2+3x+2}$ is

(A) $R - \{1, 2\}$

(B) $(-2, \infty)$

(C) $R - \{-1, -2, -3\}$

(D) $(-3, \infty) - \{-1, -2\}$

106. The equation of pair of lines $y = px$ and $y = qx$ can be written as $(y - px)(y - qx) = 0$. Then the equation of the pair of the angle bisectors of the lines $x^2 - 4xy - 5y^2 = 0$ is

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

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

107. The equation $(\cos p - 1)x^2 + (\cos p)x + \sin p = 0$ in the variable x , has real roots. Then p can take any value in the interval

(A) $(0, 2\pi)$ (B) $(-\pi, 0)$

(C) $(-\frac{\pi}{2}, \frac{\pi}{2})$ (D) $(0, \pi)$

108. If $\bar{a} = \frac{1}{\sqrt{10}}(4\hat{i} - 3\hat{j} + \hat{k}), \bar{b} = \frac{1}{5}(\hat{i} + 2\hat{j} + 2\hat{k})$, then the value of $(2\bar{a} - \bar{b}) \cdot \{(\bar{a} \times \bar{b}) \times (\bar{a} + 2\bar{b})\}$ is

(A) 5 (B) -3

(C) -5 (D) 3

109. Let a random variable X have a Binomial distribution with mean 8 and variance 4 . If $P(x \leqslant 2) = \frac{k}{2^{16}}$, then k is equal to

(A) 17 (B) 121

(C) 1 (D) 137

110. If $\bar{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}, \bar{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ and $\bar{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$ are non-zero non-coplanar vectors and m is non-zero scalar such that $[m\bar{a} + \bar{b} \quad m\bar{b} + \bar{c} \quad m\bar{c} + \bar{a}] = 28[\bar{a}\bar{b}\bar{c}]$, then the value of m is equal to

(A) 2 (B) 3

(C) 4 (D) 7

111. The area of the region, bounded by the parabola $y = x^2 + 2$ and the lines $y = x, x = 0$ and $x = 3$, is

(A) $\frac{9}{2}$ sq. units (B) $\frac{11}{2}$ sq. units

(C) $\frac{15}{2}$ sq. units (D) $\frac{21}{2}$ sq. units

112. If $0 < x < 1$, then

$$\sqrt{1 + x^2}$$

$$\left[\left\{x\cos\left(\cot^{-1}x\right) + \sin\left(\cot^{-1}x\right)\right\}^2 - 1\right]^{\frac{1}{2}} =$$

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

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

113. For the probability distribution

X :	-2	-1	0	1	2	3
p (x) :	0.1	0.2	0.2	0.3	0.15	0.05

Then the Var(X) is
(Given :

$$(0.25)^2 = 0.0625, (0.35)^2 = 0.1225,$$
$$(0.45)^2 = 0.2025\big)$$

(A) 0.8275 (B) 1.1225
(C) 1.8275 (D) 2.0725

114. The number of all values of θ in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ satisfying the equation $(1-\tan\theta)(1+\tan\theta)\sec^2\theta + 2\tan^2\theta = 0$ is

(A) 1 (B) 0
(C) 2 (D) infinitely many.

115. Two cards are drawn successively with replacement from a well- shuffled pack of 52 cards. Let X denote the random variable of number of kings obtained in the two drawn cards. Then $P(x=1) + P(x=2)$ equals

(A) $\frac{49}{169}$ (B) $\frac{24}{169}$
(C) $\frac{52}{169}$ (D) $\frac{25}{169}$

116. The curve $y = ax^3 + bx^2 + cx + 5$ touches the x-axis at $(-2, 0)$ and cuts the y-axis at a point Q where its gradient is 3 , then the value of a + b + c is

(A) $\frac{7}{8}$ (B) $\frac{7}{4}$
(C) $\frac{7}{2}$ (D) $\frac{7}{12}$

117. Let L_1 $\frac{x+1}{3} = \frac{y+2}{2} = \frac{z+1}{1}$ and $L_2 : \frac{x-2}{2} = \frac{y+2}{1} = \frac{z-3}{3}$ be the given lines. Then the unit vector perpendicular to L_1 and L_2 is

(A) $\frac{-5\hat{i}+7\hat{j}+2\hat{k}}{\sqrt{78}}$ (B) $\frac{5\hat{i}-7\hat{j}+\hat{k}}{5\sqrt{3}}$
(C) $\frac{5\hat{i}-7\hat{j}-\hat{k}}{5\sqrt{3}}$ (D) $\frac{5\hat{i}+7\hat{j}-\hat{k}}{5\sqrt{3}}$

118. If $y = a\log x + bx^2 + x$ has its extreme value at $x = -1$ and $x = 2$, then the value of $a + b$ is

(A) $\frac{3}{2}$ (B) $\frac{1}{2}$
(C) $\frac{5}{2}$ (D) $\frac{3}{4}$

119. The value of the integral $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \left(x^2 + \log\frac{\pi-x}{\pi+x}\right)\cos x dx$ is equal to

(A) 0 (B) $\frac{\pi^2}{2} - 4$
(C) $\frac{\pi^2}{2}$ (D) $\frac{\pi^2}{2} + 4$

120. For the system $x - y + z = 4, 2x + y - 3z = 0, x + y + z = 2$, the values of x, y, z respectively are given by

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

121. The value of $\int \sin\sqrt{x}\mathrm{dx}$ is equal to

(A) $\sin\sqrt{x} - 2\sqrt{x}\cos\sqrt{x} + c$, where c is a constant of integration.

(B) $2\cos\sqrt{x} - 2\sqrt{x}\sin\sqrt{x} + \mathrm{c}$, where c is a constant of integration.

(C) $\cos\sqrt{x} - 2\sqrt{x}\sin\sqrt{x} + c$, where c is a constant of integration.

(D) $2\sin\sqrt{x} - 2\sqrt{x}\cos\sqrt{x} + c$, where c is a constant of integration.

122. If the vectors $\overline{AB} = 3\hat{i} + 4\hat{k}$ and $\overline{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$ are the sides of the triangle ABC, then the length of the median through A is

(A) $\sqrt{45}$ units (B) $\sqrt{18}$ units
(C) $\sqrt{72}$ units (D) $\sqrt{33}$ units

123. If $f(x) = x^3 + bx^2 + cx + d$ and $0 < b^2 < c$, then in $(-\infty, \infty)$

(A) $f(x)$ is strictly increasing function (B) f(x) is bounded
(C) f(x) has a local maxima (D) f(x) is a strictly decreasing function

124. If $f\left(\frac{x-4}{x-2}\right) = 2x + 1, x \in \mathbb{R} - \{1, -2\}$, then $\int f(x)dx$ is equal to

(A) $5x - 4\log(x-1) + \mathrm{c}$, where c is constant of integration.

(B) $x - 4\log(x-1) + c$, where c is constant of integration.

(C) $5x + 4\log(x-1) + \mathrm{c}$, where c is constant of integration.

(D) $5x + \log(x-1) + \mathrm{c}$, where c is constant of integration.

125. If $\sin(\theta-\alpha), \sin\theta$ and $\sin(\theta+\alpha)$ are in H.P, then the value of $\cos^2\theta$ is

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

(C) $1-4\cos^2\frac{\alpha}{2}$ (D) $1+4\cos^2\frac{\alpha}{2}$

126. The equation of the plane passing through the point $(1,1,1)$ and perpendicular to the planes $2x-y-2z=5$ and $3x-6y+2z=7$ is

(A) $14x+10y+9z=13$

(B) $14x+10y+9z=33$

(C) $14x+10y+9z=-15$

(D) $14x+10y+9z=-33$

127. The tangent to the circle $x^2+y^2=5$ at $(1,-2)$ also touches the circle $x^2+y^2-8x+6y+20=0$ then the co-ordinates of the corresponding point of contact is

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

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

128. The general solution of the differential equation $x\cos y\,dy=(xe^x\log x+e^x)\,dx$ is given by

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

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

(C) $e^x\sin y=\log x+c$, where c is a constant of integration.

(D) $\sin y=ce^x+\log x$, where c is a constant of integration.

129. The equation $(\cos p-1)x^2+(\cos p)x+\sin p=0$ in the variable x , has real roots. Then p can take any value in the interval

(A) $(0,2\pi)$ (B) $(-\pi,0)$

(C) $(-\frac{\pi}{2},\frac{\pi}{2})$ (D) $(0,\pi)$

130. A committee of 11 members is to be formed from 8 males and 5 females. If m is the number of ways the committee is formed with at least 6 males and n is the number of ways the committee is formed with at least 3 females, then

(A) $m+n=68$ (B) $m=n=78$

(C) $m=n=68$ (D) $n=m-8$

131. If $y=[(x+1)(2x+1)(3x+1)\ldots\ldots\ldots(nx+1)]^4$ then $\frac{dy}{dx}$ at $x=0$ is

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

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

132. Let α and β be two real roots of the equation $(k+1)\tan^2 x-\sqrt{2}\lambda\tan x=(1-k)$ where $k(\neq -1)$ and λ are real numbers. If $\tan^2(\alpha+\beta)=50$, then a value of λ is

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

(C) 10 (D) 5

133. Let $\bar{a}=\hat{j}-\hat{k}$ and $\bar{c}=\hat{i}-\hat{j}-\hat{k}$. Then the vector $\bar{b}$ satisfying $\bar{a}\times\bar{b}+\bar{c}=\bar{0}$ and $\bar{a}\cdot\bar{b}=3$, is

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

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

134. The maximum value of $Z=x+y$, subjected to $x+y\leq 10, 5x+3y\geq 15, x\leq 6, x,y\geq 0$

(A) occurs only at unique point

(B) occurs only at two distinct points

(C) occurs at infinitely many points

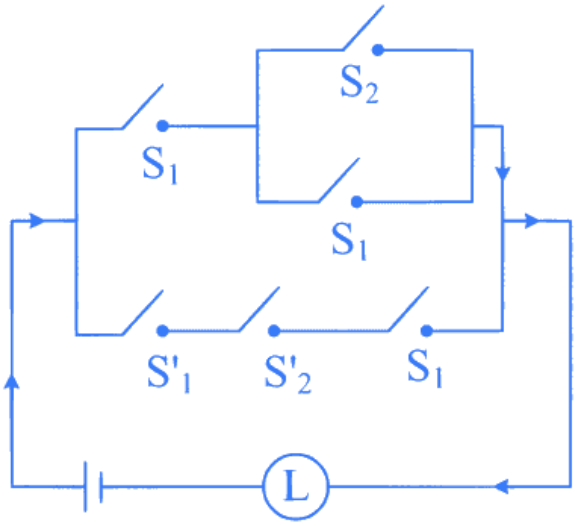
(D) does not exist

135. Equation of the plane containing the straight line $\frac{x}{2}=\frac{y}{3}=\frac{z}{4}$ and perpendicular to the plane containing the straight lines $\frac{x}{3}=\frac{y}{4}=\frac{z}{2}$ and $\frac{x}{4}=\frac{y}{2}=\frac{z}{3}$ is

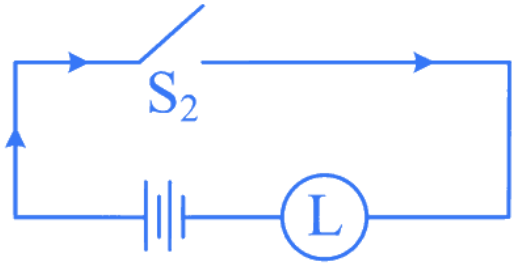
(A) $x+2y-2z=0$ (B) $3x+2y-2z=0$

(C) $x-2y+z=0$ (D) $5x+2y-4z=0$

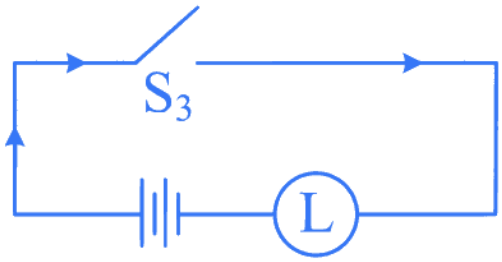
136. The new switching circuit for the following circuit by simplifying the given circuit is



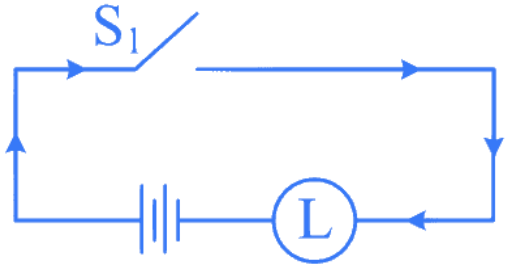
(A)



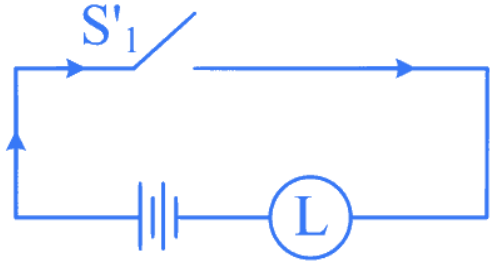
(B)



(C)



(D)



137. The minimum value of the function $f(x) = 2x^3 - 15x^2 + 36x - 48$ on the set $A = \{x \mid x^2 + 20 \leqslant 9x\}$ is

(A) -16 (B) -7

(C) 16 (D) 7

138. For each $x \in \mathbb{R}$, Let $[x]$ represent greatest integer function, then $\lim_{x\to 0^-} \frac{x([x]+|x|)\sin[x]}{|x|}$ is equal to

(A) 0 (B) 1

(C) sin1 (D) $-$sin1

139. If order and degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^5 + 4\frac{\left(\frac{d^2y}{dx^2}\right)^5}{\left(\frac{d^3y}{dx^3}\right)} + \frac{d^3y}{dx^3} = \sin x$, are m and n respectively, then the value of $(m^2 + n^2)$ is equal to

(A) 29 (B) 13

(C) 5 (D) 8

140. A student scores the following marks in five tests : 54, 45, 41, 43, 57. His score is not known for the sixth test. If the mean score is 48 in six tests, then the standard deviation of marks in six tests is

(A) $\frac{100}{\sqrt{3}}$ (B) $\frac{10}{\sqrt{3}}$

(C) $\frac{100}{3}$ (D) $\frac{10}{3}$

141. If $y = \tan^{-1}\left(\frac{3+2x}{2-3x}\right) + \tan^{-1}\left(\frac{3x}{1+4x^2}\right)$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{1}{1+16x^2}$ (B) $\frac{4}{1+16x^2}$

(C) $\frac{1}{1+4x^2}$ (D) $\frac{4}{1+4x^2}$

142. The value of c for which Rolle's theorem for the function $f(x) = x^3 - 3x^2 + 2x$ in the interval $[0, 2]$ are

(A) ± 1 (B) ± 2

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

143. If $A(-4, 5, P), B(3, 1, 4)$ and $C(-2, 0, q)$ are the vertices of a triangle ABC and $G(r, q, 1)$ is its centroid, then the value of $2p + q - r$ is equal to

(A) -3 (B) -6

(C) 9 (D) 4

144. The value of $\int e^x \left(\frac{1-\sin x}{1-\cos x}\right) dx$ is equal to

(A) $-e^x \cot\frac{x}{2} + c$,(where c is a constant of integration)

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

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

(D) $-e^x \operatorname{cosec}\frac{x}{2} + c$, (where c is a constant of integration)

145. If a body cools from 80°C to 60°C in the room temperature of 30°C in 30 min , then the temperature of a body after one hour is

(A) 42°C

(B) 24°C

(C) 48°C

(D) 56°C

146. Derivative of $\sin^2 x$ with respect to $e^{\cos x}$

(A) $2\sin x \cos^2 x e^{\cos x}$

(B) $\frac{2\cos x}{e^{\cos x}}$

(C) $\frac{2\sin x}{e^{\cos x}}$

(D) $\frac{-2\cos x}{e^{\cos x}}$

147. On which of the following lines lies the point of intersection of the line, $\frac{x-4}{2} = \frac{y-5}{2} = \frac{z-3}{1}$ and the plane $x + y + z = 2$?

(A) $\frac{x-1}{1} = \frac{y-3}{2} = \frac{z+4}{-5}$

(B) $\frac{x-4}{1} = \frac{y-5}{1} = \frac{z-5}{-1}$

(C) $\frac{x-2}{2} = \frac{y-3}{2} = \frac{z+3}{3}$

(D) $\frac{x+3}{3} = \frac{4-y}{3} = \frac{z+1}{-2}$

148.

$$\sim[(p \vee \sim q) \rightarrow (p \wedge \sim q)] \equiv$$

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

(B) $(p \wedge \sim q) \wedge (\sim p \wedge q)$

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

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

149. If $z^2 + z + 1 = 0$ then $\left(z^3 + \frac{1}{z^3}\right)^2 + \left(z^4 + \frac{1}{z^4}\right)^2 =$ where $z = w =$ complex cube root of unity

(A) 4

(B) 1

(C) 5

(D) 2

150. Two cards are drawn successively with replacement from a well shuffled pack of 52 cards. Then mean of number of kings is

(A) $\frac{1}{13}$

(B) $\frac{1}{169}$

(C) $\frac{2}{13}$

(D) $\frac{4}{169}$

- End of Question Paper -