

- Q11. The equation $\sqrt{3x^2 + x + 5} = x - 3$, where x is real, has
 A) No solution
 B) Exactly one solution
 C) Exactly two solutions
 D) Exactly four solutions
- Q12. Let $f : R \rightarrow R$ be a function such that $|f(x)| \leq x^2$, for all $x \in R$. Then, at $x = 0$, f is
 A) Not continuous as $LHL \neq RHL$
 B) Not continuous as $LHL = RHL \neq f(0)$
 C) Continuous
 D) Cannot be determined
- Q13. If the angle between the line $2(x + 1) = y = z + 4$ and the plane $2x - y + \sqrt{\lambda}z + 4 = 0$ is $\frac{\pi}{6}$, then the value of λ is
 A) $\frac{135}{7}$
 B) $\frac{45}{11}$
 C) $\frac{45}{7}$
 D) $\frac{135}{11}$
- Q14. The area of the region above the x -axis bounded by the curve $y = \tan x$, $0 \leq x \leq \frac{\pi}{4}$ and the tangent to the curve at $x = \frac{\pi}{4}$ is
 A) $\frac{1}{2} (\log 2 - \frac{1}{2})$
 B) $\frac{1}{2} (\log 2 + \frac{1}{2})$
 C) $\frac{1}{2} (1 - \log 2)$
 D) $\frac{1}{2} (1 + \log 2)$
- Q15. If $\frac{dy}{dx} + y \tan x = \sin 2x$ and $y(0) = 1$, then $y(\pi)$ is equal to
 A) 1
 B) -1
 C) -5
 D) 5
- Q16. The function $f(x) = |\sin 4x| + |\cos 2x|$, is a periodic function with period
 A) 2π
 B) π
 C) $\frac{\pi}{2}$
 D) $\frac{\pi}{4}$
- Q17. If $\vec{x} = 3\vec{i} - 6\vec{j} - \vec{k}$, $\vec{y} = \vec{i} + 4\vec{j} - 3\vec{k}$ and $\vec{z} = 3\vec{i} - 4\vec{j} - 12\vec{k}$, then the magnitude of the projection of $\vec{x} \times \vec{y}$ on \vec{z} is
 A) 12
 B) 15
 C) 14
 D) 13
- Q18. A wire of length ' l ' is cut into 3 pieces. What is the probability that the 3 pieces will make a triangle?
 A) $\frac{1}{2}$
 B) $\frac{1}{4}$
 C) $\frac{1}{8}$
 D) $\frac{2}{3}$
- Q19. For all complex numbers z of the form $1 + i\alpha$, $\alpha \in R$, if $z^2 = x + iy$, then
 A) $y^2 - 4x + 2 = 0$
 B) $y^2 + 4x - 4 = 0$
 C) $y^2 - 4x + 4 = 0$
 D) $y^2 + 4x + 2 = 0$

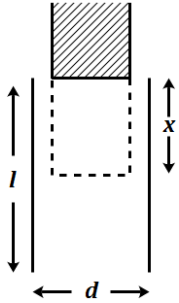
- Q20. Let \bar{x} , M and σ^2 be respectively the mean, mode and variance of n observations x_1, x_2, \dots, x_n and $d_i = -x_i - a, i = 1, 2, \dots, n$, where a is any number.
 Statement I: Variance of d_1, d_2, \dots, d_n is σ^2
 Statement II: Mean and mode of d_1, d_2, \dots, d_n are $-\bar{x} - a$ and $-M - a$, respectively
- A) Statement I and statement II are both false
 B) Statement I and statement II are both true
 C) Statement I is true and statement II is false
 D) Statement I is false and statement II is true
- Q21. The circumcentre of a triangle lies at the origin and its centroid is the mid point of the line segment joining the points $(a^2 + 1, a^2 + 1)$ and $(2a, -2a)$, $a \neq 0$, Then for any a , the orthocentre of this triangle lies on the line
- A) $y - 2ax = 0$
 B) $y - (a^2 + 1)x = 0$
 C) $y + x = 0$
 D) $(a - 1)^2 x - (a + 1)^2 y = 0$
- Q22. The contrapositive of the statement "If I am not feeling well, then I will go to the doctor" is
- A) If I am feeling well, then I will not go to the doctor
 B) If I will go to the doctor, then I am feeling well
 C) If I will not go to the doctor, then I am feeling well
 D) If I will go to the doctor, then I am not feeling well
- Q23. The coefficient of x^{1012} in the expansion of $(1 + x^n + x^{253})^{10}$, (Where $n \leq 22$ is any positive integer), is:
- A) 1
 B) ${}^{10}C_4$
 C) $4n$
 D) ${}^{253}C_4$
- Q24. The number of terms in an $A.P.$ is even; the sum of the odd terms in it is 24 and that of the even terms is 30. If the last term exceeds the first term by $10\frac{1}{2}$, then the number of terms in the $A.P.$ is
- A) 4
 B) 8
 C) 12
 D) 16
- Q25. Let $f(n) = [\frac{1}{3} + \frac{3n}{100}]n$, where $[n]$ denotes the greatest integer less than or equal to n .
 Then $\sum_{n=1}^{56} f(n)$ is equal to
- A) 56
 B) 689
 C) 1287
 D) 1399

- Q26. If a line L is perpendicular to the line $5x - y = 1$, and the area of the triangle formed by the line L and the coordinate axes is 5, then the distance of line L from the line $x + 5y = 0$ is
- A) $\frac{7}{\sqrt{5}}$ B) $\frac{5}{\sqrt{13}}$
- C) $\frac{7}{\sqrt{13}}$ D) $\frac{5}{\sqrt{7}}$
- Q27. The equation of circle described on the chord $3x + y + 5 = 0$ of the circle $x^2 + y^2 = 16$ as diameter is
- A) $x^2 + y^2 + 3x + y - 11 = 0$ B) $x^2 + y^2 + 3x + y + 1 = 0$
- C) $x^2 + y^2 + 3x + y - 2 = 0$ D) $x^2 + y^2 + 3x + y - 22 = 0$
- Q28. A chord is drawn through the focus of the parabola $y^2 = 6x$ such that its distance from the vertex of this parabola is $\frac{\sqrt{5}}{2}$, then its slope can be
- A) $\frac{\sqrt{5}}{2}$ B) $\frac{\sqrt{3}}{2}$
- C) $\frac{2}{\sqrt{5}}$ D) $\frac{2}{\sqrt{3}}$
- Q29. The tangent at an extremity (in the first quadrant) of latus rectum of the hyperbola $\frac{x^2}{4} - \frac{y^2}{5} = 1$, meets x -axis and y -axis at A and B respectively. Then $(OA)^2 - (OB)^2$, where O is the origin, equals
- A) $-\frac{20}{9}$ B) $\frac{16}{9}$
- C) 4 D) $-\frac{4}{3}$
- Q30. Equation of the line of the shortest distance between the lines $\frac{x}{1} = \frac{y}{-1} = \frac{z}{1}$ and $\frac{x-1}{0} = \frac{y+1}{-2} = \frac{z}{1}$ is
- A) $\frac{x}{1} = \frac{y}{-1} = \frac{z}{-2}$ B) $\frac{x-1}{1} = \frac{y+1}{-1} = \frac{z}{-2}$
- C) $\frac{x-1}{1} = \frac{y+1}{-1} = \frac{z}{1}$ D) $\frac{x}{-2} = \frac{y}{1} = \frac{z}{2}$

SECTION II-PHYSICS

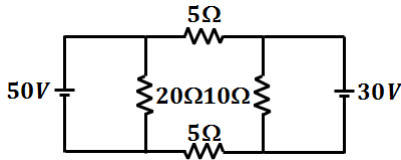
- Q31. In terms of resistance R and time T , the dimension of ratio $\frac{\mu}{\epsilon}$ of the permeability μ and permittivity ϵ is:
- A) $[RT^{-2}]$ B) $[R^{-2}T^{-1}]$
- C) $[R^2]$ D) $[R^2T^2]$

- Q47. A parallel plate capacitor is made of two plates of length l , width ω and separated by distance d . A dielectric slab (dielectric constant K) that fits exactly between the plates is held near the edge of the plates. It is pulled into the capacitor by a force $F = -\frac{\partial U}{\partial x}$, where U is energy of the capacitor when dielectric is inside the capacitor up to the distance x . If the charge on the capacitor is Q then the force on the dielectric when it is near the edge is:



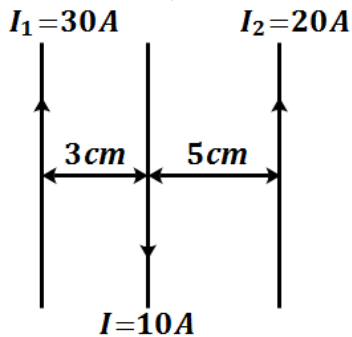
- A) $\frac{Q^2 d}{2\omega l^2 \epsilon_0} K$ B) $\frac{Q^2 \omega}{2dl^2 \epsilon_0} (K - 1)$
 C) $\frac{Q^2 d}{2\omega l^2 \epsilon_0} (K - 1)$ D) $\frac{Q^2 \omega}{2dl^2 \epsilon_0} K$

- Q48. In the circuit shown, currents (in A) through the 50V and 30V batteries are, respectively:



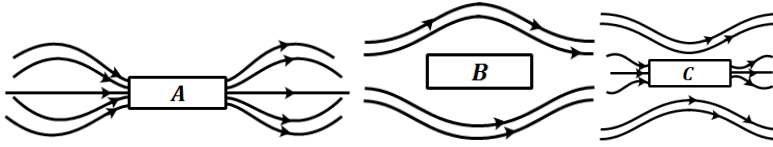
- A) 25 and 3 B) 3.5 and 2
 C) 4.5 and 1 D) 3 and 2.5

- Q49. Three straight parallel current carrying conductors are shown in the figure. The force experienced by the middle conductor of length 25 cm is



- A) $3 \times 10^{-4} N$ towards right B) $6 \times 10^{-4} N$ towards left
 C) $9 \times 10^{-4} N$ towards left D) Zero

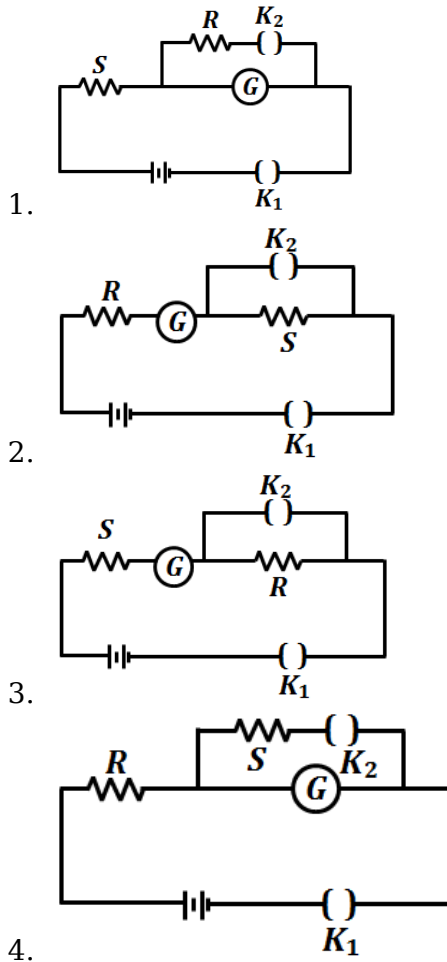
- Q50. Three identical bars A, B and C are made of different magnetic materials. When kept in a uniform magnetic field, the field lines around them look as follows:



Make the correspondence of these bars with their material being diamagnetic (D), ferromagnetic (F) and paramagnetic (P)

- A) $A \leftrightarrow D, B \leftrightarrow P, C \leftrightarrow F$ B) $A \leftrightarrow F, B \leftrightarrow D, C \leftrightarrow P$
 C) $A \leftrightarrow P, B \leftrightarrow F, C \leftrightarrow D$ D) $A \leftrightarrow F, B \leftrightarrow P, C \leftrightarrow D$
- Q51. A coil of circular cross-section having 1000 turns and 4 cm^2 face area is placed with its axis parallel to a magnetic field which decreases by $10^{-2} \text{ Wb m}^{-2}$ in 0.01 s . The E.M.F. induced in the coil is:
- A) 400 mV B) 200 mV
 C) 4 mV D) 0.4 mV
- Q52. An electromagnetic wave of frequency $1 \times 10^{14} \text{ Hz}$ is propagating along z -axis. The amplitude of electric field is 4 V/m . If $\epsilon_0 = 8.8 \times 10^{-12} \text{ C}^2/\text{N-m}^2$, then average energy density of electric field will be:
- A) $35.2 \times 10^{-10} \text{ J/m}^3$ B) $35.2 \times 10^{-11} \text{ J/m}^3$
 C) $35.2 \times 10^{-12} \text{ J/m}^3$ D) $35.2 \times 10^{-13} \text{ J/m}^3$
- Q53. An object is located in a fixed position in front of a screen. Sharp image is obtained on the screen for two positions of a thin lens separated by 10 cm . The sizes of the image in the two situations are in the ratio $3 : 2$. What is the distance between the screen and the object?
- A) 124.5 cm B) 144.5 cm
 C) 65.0 cm D) 99.0 cm
- Q54. Two monochromatic light beams of intensity 16 and 9 units are interfering. The ratio of intensities of bright and dark parts of the resultant pattern is:
- A) $\frac{16}{9}$ B) $\frac{4}{3}$
 C) $\frac{7}{1}$ D) $\frac{49}{1}$
- Q55. In a compound microscope the focal length of objective lens is 1.2 cm and focal length of eye piece is 3.0 cm . The tube length of the microscope is 12. Magnifying power of the compound microscope should be:
- A) 200 B) 100
 C) 400 D) 150

Q60. In the circuit diagrams (1, 2, 3 and 4) shown below, R is a high resistance and S is a resistance of the order of galvanometer resistance G . The correct circuit, corresponding to the half deflection method for finding the resistance and figure of merit of the galvanometer, is the circuit labelled as:



A) Circuit 1 with $G = \frac{RS}{R-S}$

B) Circuit 2 with $G = S$

C) Circuit 3 with $G = S$

D) Circuit 4 with $G = \frac{RS}{R-S}$

SECTION III-CHEMISTRY

Q61. In a face centred cubic lattice atoms A are at the corner points and atoms B at the face centred points. If atom B is missing from one of the face centred points, the formula of the ionic compound is:

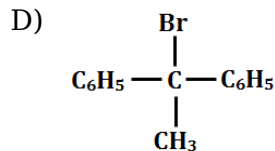
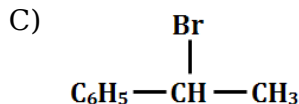
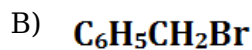
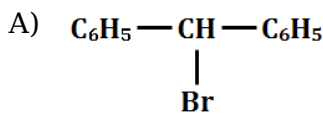
A) AB_2

B) A_5B_2

C) A_2B_3

D) A_2B_5

Q62. In a nucleophilic substitution reaction: $R-Br + Cl^- \xrightarrow{DMF} R-Cl + Br^-$, which one of the following undergoes complete inversion of configuration?



Q63. The half-life period of a first order reaction is 15 minutes. The amount of substance left after one hour will be:

A) 1/4 of the original amount

B) 1/8 of the original amount

C) 1/16 of the original amount

D) 1/32 of the original amount

Q64. In the following sets of reactants which two sets best exhibit the amphoteric character of $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$?

Set1 : $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(s)$ and $\text{OH}^- (aq)$

Set2 : $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(s)$ and $\text{H}_2\text{O}(l)$

Set3 : $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(s)$ and $\text{H}^+ (aq)$

Set4 : $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(s)$ and $\text{NH}_3 (aq)$

A) 1 and 2

B) 1 and 3

C) 2 and 4

D) 3 and 4

Q65. Allyl phenyl ether can be prepared by heating:

A) $\text{C}_6\text{H}_5\text{Br} + \text{CH}_2 = \text{CH} - \text{CH}_2 - \text{ONa}$

B) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{Br} + \text{C}_6\text{H}_5\text{ONa}$

C) $\text{C}_6\text{H}_5 - \text{CH} = \text{CH} - \text{Br} + \text{CH}_3 - \text{ONa}$

D) $\text{CH}_2 = \text{CH} - \text{Br} + \text{C}_6\text{H}_5 - \text{CH}_2\text{ONa}$

Q66. Chloro compound of Vanadium has only spin magnetic moment of 1.73 BM. This Vanadium chloride has the formula: (At. No. of V = 23)

A) VCl_2

B) VCl_4

C) VCl_3

D) VCl_5

Q67. The temperature at which oxygen molecules have the same root mean square speed as helium atoms have at 300K is: (Atomic masses: $\text{He} = 4u, \text{O} = 16u$)

A) 300K

B) 600K

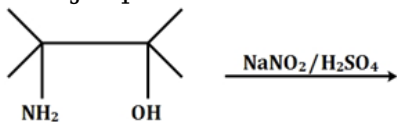
C) 1200K

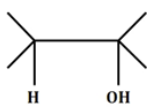
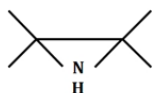
D) 2400K

Q68. The standard enthalpy of formation of NH_3 is -46.0kJ/mol . If the enthalpy of formation of H_2 from its atoms is -436kJ/mol and that of N_2 is -712kJ/mol , the average bond enthalpy of $N-H$ bond in NH_3 is:

- A) -1102kJ/mol B) -964kJ/mol
 C) $+352\text{kJ/mol}$ D) $+1056\text{kJ/mol}$

Q69. The major product of the reaction is

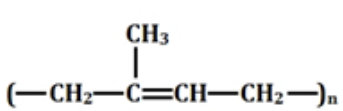
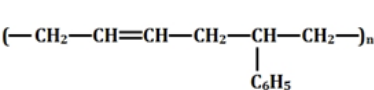
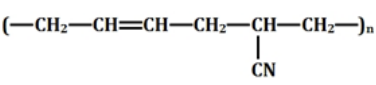
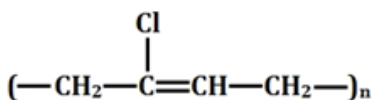


- A)  B) 
 C)  D) 

Q70. The amount of oxygen in 3.6 moles of water is:

- A) 115.5g B) 57.6g
 C) 28.8g D) 18.4g

Q71. Structure of some important polymers are given. Which one represents Buna-S?

- A)  B) 
 C)  D) 

Q72. At a certain temperature, only 50% HI is dissociated into H_2 and I_2 at equilibrium. The equilibrium constant is:

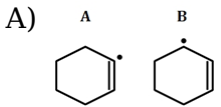
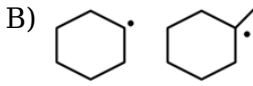

- A) 1.0 B) 3.0
 C) 0.5 D) 0.25

Q73. Which of the following is not formed when H_2S reacts with acidic $K_2Cr_2O_7$ solution?

- A) $CrSO_4$ B) $Cr_2(SO_4)_3$
 C) K_2SO_4 D) S

Q74. Which of the following has unpaired electron(s)?

- A) N_2 B) O_2^-
 C) N_2^{2+} D) O_2^{2-}

- Q83. Which one of the following class of compounds is obtained by polymerization of acetylene?
 A) Poly-yne
 B) Poly-ene
 C) Poly-ester
 D) Poly-amide
- Q84. Dissolving 120g of a compound of (*mol. Wt.* 60) in 1000g of water gave a solution of density 1.12g/mL. The molarity of the solution is:
 A) 1.00M
 B) 2.00M
 C) 2.50M
 D) 4.00M
- Q85. An octahedral complex of Co^{3+} is diamagnetic. The hybridization involved in the formation of the complex is (*At. No.* = 27) :
 A) sp^3d^2
 B) dsp^2
 C) d^2sp^3
 D) dsp^3
- Q86. In the hydroboration - oxidation reaction of propene with diborane, H_2O_2 and $NaOH$, the organic compound formed is:
 A) CH_3CH_2OH
 B) $CH_3CHOHCH_3$
 C) $CH_3CH_2CH_2OH$
 D) $(CH_3)_3COH$
- Q87. For the compounds CH_3Cl , CH_3Br , CH_3I and CH_3F , the correct order of increasing $C - X$ bond length, where X is the halogen is:
 A) $CH_3F < CH_3Cl < CH_3Br < CH_3I$
 B) $CH_3F < CH_3Br < CH_3Cl < CH_3I$
 C) $CH_3F < CH_3I < CH_3Br < CH_3Cl$
 D) $CH_3Cl < CH_3Br < CH_3F < CH_3I$
- Q88. The gas evolved on heating CaF_2 and SiO_2 with concentrated H_2SO_4 , on hydrolysis gives a white gelatinous precipitate. The precipitate is:
 A) Hydrofluorosilicic acid
 B) Silica gel
 C) Silicic acid
 D) Calcium fluorosilicate
- Q89. The energy of an electron in first Bohr orbit of H -atom is $-13.6eV$. The energy value of electron in the excited state of Li^{2+} is :
 A) $-27.2 eV$
 B) $30.6 eV$
 C) $-30.6 eV$
 D) $27.2 eV$
- Q90. In which of the following pairs(A,B), A is more stable than B ?
 A) 
 B) 
 C) 
 D) Ph_3C^\bullet , $(CH_3)_3C^\bullet$