Q1. Given below are two statements : Statement (I) : Dimensions of specific heat is $\left[\mathrm{L}^2\ \mathrm{T}^{-2}\ \mathrm{K}^{-1}\right]$. Statement (II) : Dimensions of gas constant is $\left[\mathrm{ML}^2\ \mathrm{T}^{-1}\ \mathrm{K}^{-1}\right]$. In the light of the above statements, choose the most appropriate answer from the options given below.

(1) Both statement (I) and statement (II) are correct

(2) Statement (I) is correct but statement (II) is incorrect

(3) Both statement (I) and statement (II) are incorrect

(4) Statement (I) is incorrect but statement (II) is correct

Q2. A body projected vertically upwards with a certain speed from the top of a tower reaches the ground in t_1. If it is projected vertically downwards from the same point with the same speed, it reaches the ground in t_2. Time required to reach the ground, if it is dropped from the top of the tower, is :

(1) $\sqrt{t_1 t_2}$

(2) $\sqrt{t_1 + t_2}$

(3) $\sqrt{t_1 - t_2}$

(4) $\sqrt{\frac{t_1}{t_2}}$

Q3. A body of weight 200 N is suspended from a tree branch through a chain of mass 10 kg. The branch pulls the chain by a force equal to (if $g = 10\ \mathrm{m/s^2}$) :

(1) 100 N

(2) 200 N

(3) 300 N

(4) 150 N

Q4. A car of 800 kg is taking turn on a banked road of radius 300 m and angle of banking 30°. If coefficient of static friction is 0.2 then the maximum speed with which car can negotiate the turn safely:

$\left(\mathrm{g} = 10\ \mathrm{m/s^2}, \sqrt{3} = 1.73\right)$

(1) $264\ \mathrm{m/s}$

(2) $51.4\ \mathrm{m/s}$

(3) $70.4\ \mathrm{m/s}$

(4) $102.8\ \mathrm{m/s}$

Q5. When kinetic energy of a body becomes 36 times of its original value, the percentage increase in the momentum of the body will be:

(1) 6%

(2) 600%

(3) 60%

(4) 500%

Q6. Assuming the earth to be a sphere of uniform mass density, a body weighed 300 N on the surface of earth. How much it would weigh at R/4 depth under surface of earth ?

(1) 75 N

(2) 300 N

(3) 375 N

(4) 225 N

Q7. Pressure inside a soap bubble is greater than the pressure outside by an amount : (given : R = Radius of bubble S = Surface tension of bubble)

(1) $\frac{2S}{R}$

(2) $\frac{4R}{S}$

(3) $\frac{S}{R}$

(4) $\frac{4\,\mathrm{S}}{\mathrm{R}}$

Q8. A total of 48 J heat is given to one mole of helium kept in a cylinder. The temperature of helium increases by $2^\circ\mathrm{C}$. The work done by the gas is: Given, $\mathrm{R} = 8.3\ \mathrm{J\ K^{-1}\ mol^{-1}}$.

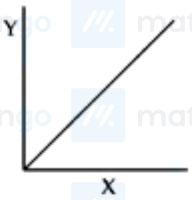
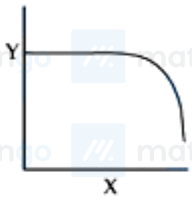
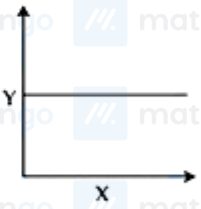
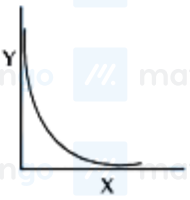
(1) 24.9 J (2) 72.9 J
(3) 48 J (4) 23.1 J

Q9. Energy of 10 non rigid diatomic molecules at temperature T is :
(1) $70\ \mathrm{K_BT}$ (2) $35\ \mathrm{K_BT}$
(3) $\frac{7}{2}\mathrm{RT}$ (4) $35\mathrm{RT}$

Q10. Two identical conducting spheres P and S with charge Q on each, repel each other with a force 16 N. A third identical uncharged conducting sphere R is successively brought in contact with the two spheres. The new force of repulsion between P and S is :
(1) 1 N (2) 6 N
(3) 12 N (4) 4 N

Q11. The number of electrons flowing per second in the filament of a 110 W bulb operating at 220 V is : (Given $\mathrm{e} = 1.6 \times 10^{-19}\mathrm{C}$)
(1) 6.25×10^{17} (2) 1.25×10^{19}
(3) 6.25×10^{18} (4) 31.25×10^{17}

Q12. Match List-I with List-II :

List-I Y vs X	List-II Shape of Graph
(A) Y = magnetic susceptibility X = magnetising field	(I) 
(B) Y = magnetic field X = distance from centre of a current carrying wire for $x < a$ (where a = radius of wire)	(II) 
(C) Y = magnetic field X = distance from centre of a current carrying wire for $x > a$ (where a = radius of wire)	(III) 
(D) Y = magnetic field inside solenoid X = distance from centre	(IV) 

Choose the correct answer from the options given below :

(1) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
(2) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
(3) (A)-(III), (B)-(IV), (C)- (I), (D)-(II)
(4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Q13. In a coil, the current changes from -2 A to $+2$ A in 0.2 s and induces an emf of 0.1 V. The self inductance of the coil is :

(1) 4mH
(2) 1mH
(3) 5mH
(4) 2.5mH

Q14. In the given electromagnetic wave $E_y = 600\sin(\omega t - kx)Vm^{-1}$, intensity of the associated light beam is (in W/m^2 : (Given $\epsilon_0 = 9 \times 10^{-12} C^2\ N^{-1}\ m^{-2}$)

(1) 243
(2) 729
(3) 972
(4) 486

Q15. In finding out refractive index of glass slab the following observations were made through travelling microscope 50 vernier scale division $=$ 49MSD; 20 divisions on main scale in each cm For mark on paper

MSR $= 8.45$ cm, VC $= 26$ For mark on paper seen through slab MSR $= 7.12$ cm, $VC = 41$ For powder particle on the top surface of the glass slab MSR $= 4.05$ cm, VC $= 1$ (MSR = Main Scale Reading, VC = Vernier Coincidence) Refractive index of the glass slab is :

(1) 1.52 (2) 1.35

(3) 1.42 (4) 1.24

Q16. For the thin convex lens, the radii of curvature are at 15 cm and 30 cm respectively. The focal length the lens is 20 cm. The refractive index of the material is :

(1) 1.2 (2) 1.8

(3) 1.5 (4) 1.4

Q17. When UV light of wavelength 300 nm is incident on the metal surface having work function 2.13eV, electron emission takes place. The stopping potential is: (Given hc $= 1240$eVnm)

(1) 1.5 V (2) 4.1 V

(3) 2 V (4) 4 V

Q18. The longest wavelength associated with Paschen series is : (Given $R_H = 1.097 \times 10^7$SI unit)

(1) 3.646×10^{-6} m (2) 1.876×10^{-6} m

(3) 2.973×10^{-6} m (4) 1.094×10^{-6} m

Q19. The acceptor level of a p-type semiconductor is 6eV. The maximum wavelength of light which can create a hole would be : Given hc $= 1242$eVnm.

(1) 414 nm (2) 103.5 nm

(3) 207 nm (4) 407 nm

Q20. In a vernier calliper, when both jaws touch each other, zero of the vernier scale shifts towards left and its 4^{th} division coincides exactly with a certain division on main scale. If 50 vernier scale divisions equal to 49 main scale divisions and zero error in the instrument is 0.04 mm then how many main scale divisions are there in 1 cm ?

(1) 10 (2) 5

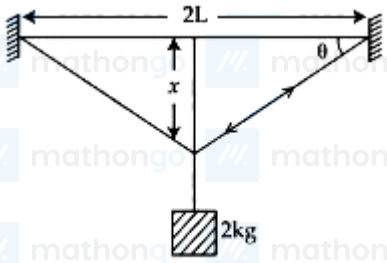
(3) 20 (4) 40

Q21. A particle moves in a straight line so that its displacement x at any time t is given by $x^2 = 1 + t^2$. Its acceleration at any time t is x^{-n} where n $=$ _____

Q22. Three balls of masses 2 kg, 4 kg and 6 kg respectively are arranged at centre of the edges of an equilateral triangle of side 2 m. The moment of intertia of the system about an axis through the centroid and perpendicular to the plane of triangle, will be _____ kgm^2.

Q23. A wire of cross sectional area A, modulus of elasticity 2×10^{11}Nm^{-2} and length 2 m is stretched between two vertical rigid supports. When a mass of 2 kg is suspended at the middle it sags lower from its original position

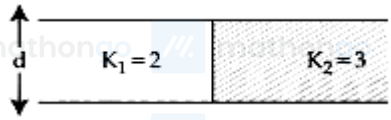
making angle $\theta = \frac{1}{100}$ radian on the points of support. The value of A is _____ $\times 10^{-4}$ m^2 (consider



$x << L$). (given : $g = 10\ m/s^2$)

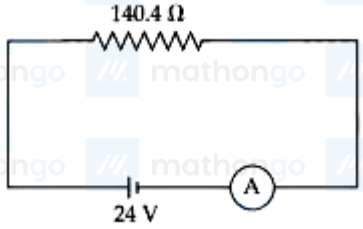
Q24. Two open organ pipes of lengths 60 cm and 90 cm resonate at 6^{th} and 5^{th} harmonics respectively. The difference of frequencies for the given modes is _____ Hz. (Velocity of sound in air $= 333\ m/s$)

Q25. A capacitor of $10\mu F$ capacitance whose plates are separated by 10 mm through air and each plate has area 4 cm^2 is now filled equally with two dielectric media of $K_1 = 2,\ K_2 = 3$ respectively as shown in figure. If new force between the plates is 8 N. The supply voltage is _____ $\times 10^{-4}$ V.



(we modified language of question to make it correct)

Q26. In the given figure an ammeter A consists of a 240Ω coil connected in parallel to a 10Ω shunt. The reading of



the ammeter is mA

Q27. A coil having 100 turns, area of 5×10^{-3} m^2, carrying current of 1 mA is placed in uniform magnetic field of 0.20 T such a way that plane of coil is perpendicular to the magnetic field. The work done in turning the coil through 90° is _____ μJ.

Q28. For a given series LCR circuit it is found that maximum current is drawn when value of variable capacitance is 25nF. If resistance of 200Ω and 100mH inductor is being used in the given circuit. The frequency of ac source is _____ $\times 10^3$ Hz. (given $\pi^2 = 10$)

Q29. Two coherent monochromatic light beams of intensities I and 4I are superimposed. The difference between maximum and minimum possible intensities in the resulting beam is xI. The value of x is $_____.

Q30. In Franck-Hertz experiment, the first dip in the current-voltage graph for hydrogen is observed at 10.2 V. The wavelength of light emitted by hydrogen atom when excited to the first excitation level is _____ nm. (Given $hc = 1245 eVnm, e = 1.6 \times 10^{-19} C$).

Q31. Molality (m) of 3M aqueous solution of NaCl is : (Given : Density of solution $= 1.25\ g\ mL^{-1}$, Molar mass in $gmol^{-1}$: $Na - 23, Cl - 35.5$)

(1) 1.9 m (2) 3.85 m
(3) 2.79 m (4) 2.90 m

Q32. The ratio $\frac{K_P}{K_C}$ for the reaction : $CO_{(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons CO_{2(g)}$ is :
(1) $\frac{1}{\sqrt{RT}}$ (2) $(RT)^{1/2}$
(3) RT (4) 1

Q33. Match List - I with List - II.

List - I Reaction	List - II Type of redox reaction
(A) $N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$	(I) Decomposition
(B) $2\,Pb(NO_3)_{2(s)} \rightarrow 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$	(II) Displacement
(C) $2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq.)} + H_{2(g)}$	(III) Disproportionation
(D) $2NO_{2(g)} + 2^-OH(aq.) \rightarrow NO^-_{2(aq.)} + NO^-_{3(aq.)} + H_2O_{(l)}$	(IV) Combination

Choose the correct answer from the options given below :
(1) (A)-(II), (B)-(III), (C)-(IV), (D)-(I) (2) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)
(3) (A)-(IV), (B)-(I), (C)-(II), (D)-(III) (4) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)

Q34. The number of ions from the following that are expected to behave as oxidising agent is :
$Sn^{4+}, Sn^{2+}, Pb^{2+}, Tl^{3+}, Pb^{4+}, Tl^{+}$
(1) 3 (2) 2
(3) 1 (4) 4

Q35. Evaluate the following statements related to group 14 elements for their correctness. (A) Covalent radius decreases down the group from C to Pb in a regular manner. (B) Electronegativity decreases from C to Pb down the group gradually. (C) Maximum covalance of C is 4 whereas other elements can expand their covalance due to presence of d orbitals. (D) Heavier elements do not form $p\pi - p\pi$ bonds. (E) Carbon can exhibit negative oxidation states. Choose the correct answer from the options given below :
(1) (A), (B) and (C) Only (2) (C), (D) and (E) Only
(3) (C) and (D) Only (4) (A) and (B) Only

Q36. The correct statement among the following, for a "chromatography" purification method is :
(1) Organic compounds run faster than solvent in the thin layer chromatographic plate. (2) R_f is an integral value.
(3) R_f of a polar compound is smaller than that of a non-polar compound. (4) Non-polar compounds are retained at top and polar compounds come down in column chromatography.

Q37. The incorrect statement regarding the geometrical isomers of 2-butene is :
(1) cis-2-butene and trans-2-butene are not interconvertible at room temperature. (2) cis-2-butene and trans-2-butene are stereoisomers.
(3) cis-2-butene has less dipole moment than trans-2-butene. (4) trans-2-butene is more stable than cis-2-butene.

Q38. How can an electrochemical cell be converted into an electrolytic cell?

(1) Applying an external opposite potential lower than E^0 cell.
(2) Reversing the flow of ions in salt bridge.
(3) Applying an external opposite potential greater than E^0 cell-
(4) Exchanging the electrodes at anode and cathode.

Q39. Arrange the following elements in the increasing order of number of unpaired electrons in it. (A) Sc (B) Cr (C) V (D) Ti (E) Mn Choose the correct answer from the options given below :

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

Q40. The correct IUPAC name of $[PtBr_2(PMe_3)_2]$ is :

(1) dibromodi(trimethylphosphine)platinum(II)
(2) bis(trimethylphosphine)dibromoplatinum(II)
(3) dibromobis(trimethylphosphine)platinum(II)
(4) bis[bromo(trimethylphosphine)]platinum(II)

Q41. Given below are two statements : Statement I : PF_5 and BrF_5 both exhibit sp^3 d hybridisation. Statement II : Both SF_6 and $[Co(NH_3)_6]^{3+}$ exhibit $sp^3\ d^2$ hybridisation. In the light of the above statements, choose the correct answer from the options given below :

(1) Statement I is true but Statement II is false
(2) Statement I is false but Statement II is true
(3) Both Statement I and Statement II are true
(4) Both Statement I and Statement II are false

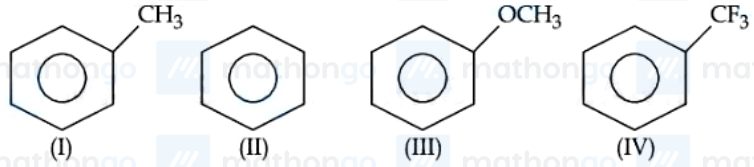
Q42.

List - I Reaction	List - II Type of redox reaction
(A) $TiCl_4$	(I) e^2, t_2^0
(B) $[FeO_4]^{2-}$	(II) e^4, t_2^3
(C) $[FeCl_4]^-$	(III) e^0, t_2^0
(D) $[CoCl_4]^{2-}$	(IV) e^2, t_2^3

Match List - I with List - II. Choose the correct answer from the options given below :

(1) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)
(2) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
(3) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(4) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)

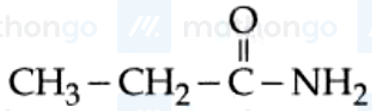
Q43.



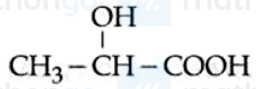
The correct arrangement for decreasing order of electrophilic substitution for above compounds is :

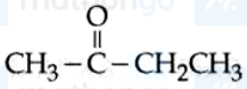
(1) (III) > (I) > (II) > (IV)
(2) (IV) > (I) > (II) > (III)
(3) (III) > (IV) > (II) > (I)
(4) (II) > (IV) > (III) > (I)

Q44. Consider the given reaction, identify the major product P. $CH_3 - COOH \xrightarrow[(iv)\ H_2O/\overline{O}H,\Delta]{(i)\ LiAlH_4\ (ii)\ PCC\ (iii)\ HCN/\overline{O}H}$ "P"

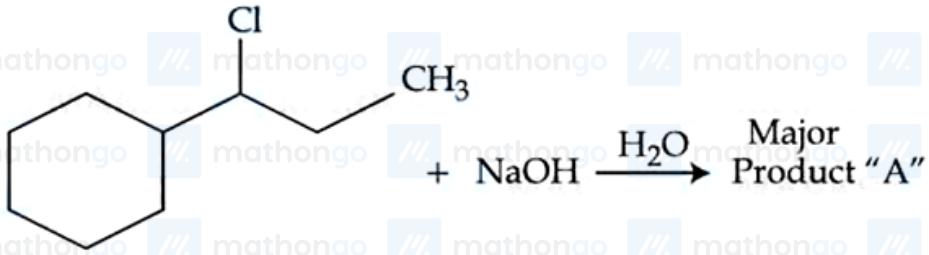
(1) 

(2) $CH_3 - CH_2 - CH_2 - OH$

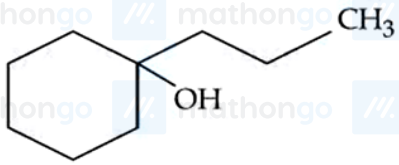
(3) 

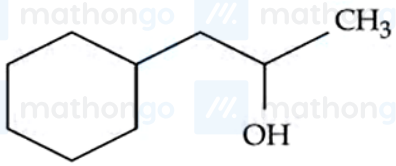
(4) 

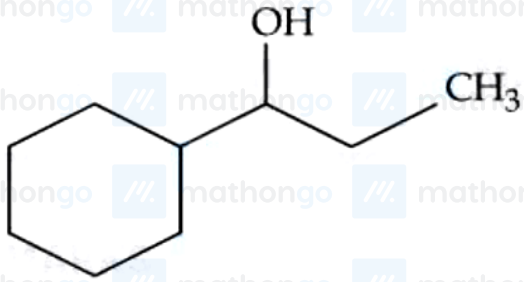
Q45.

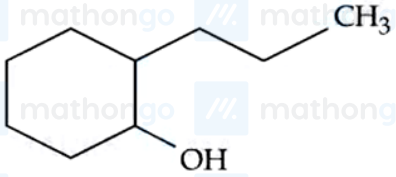


Consider the above chemical reaction. Product " A " is :

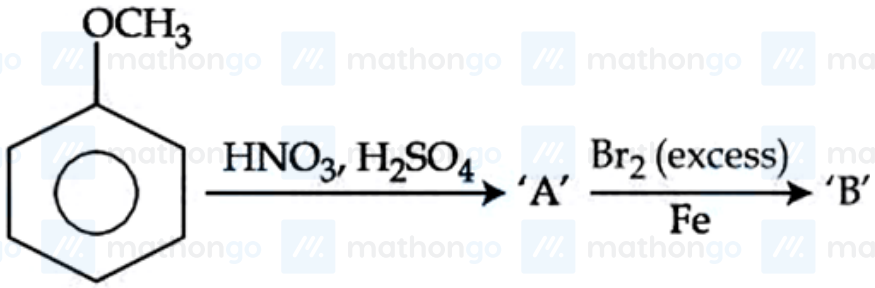
(1) 

(2) 

(3) 

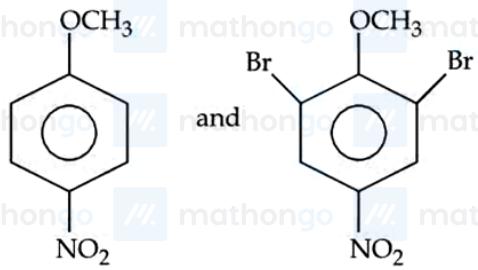
(4) 

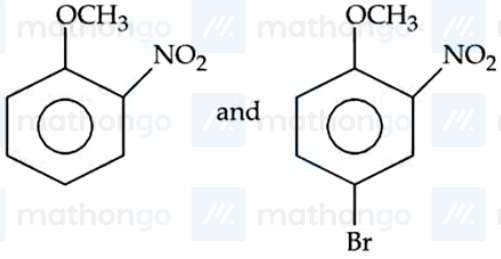
Q46.

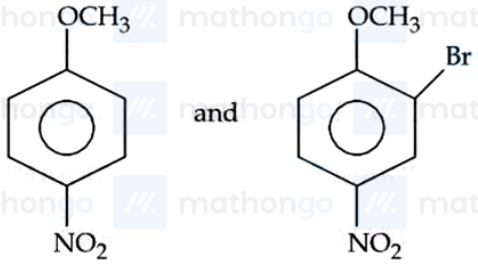


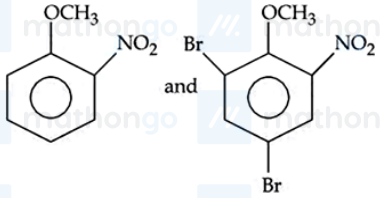
The major products formed :

A and B respectively are:

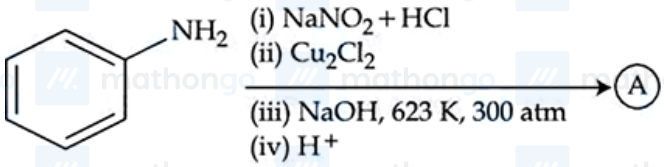
(1) 

(2) 

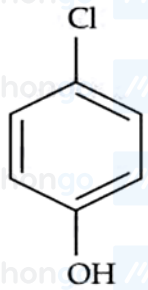
(3) 

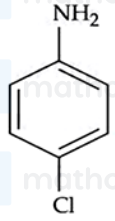
(4) 

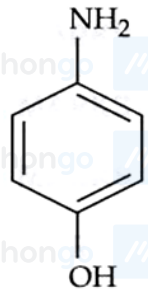
Q47.

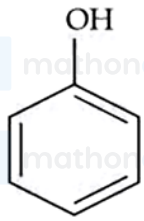


Identify the product (A) in the following reaction.

(1) 

(2) 

(3) 

(4) 

Q48. During the detection of acidic radical present in a salt, a student gets a pale yellow precipitate soluble with difficulty in NH_4OH solution when sodium carbonate extract was first acidified with dil. HNO_3 and then $AgNO_3$ solution was added. This indicates presence of :

(1) Br^- (2) I^-

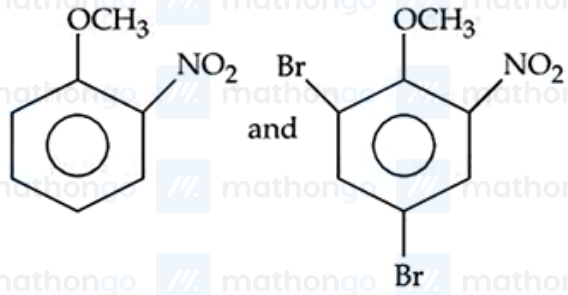
(3) Cl^- (4) CO_3^{2-}

Q49. Match List - I with List - II. Choose the correct answer from the options given below :

List - I Reaction	List - II Type of redox reaction
(A) Li	(I) 589.2
(B) Na	(II) 455.5
(C) Rb	(III) 670.8
(D) Cs	(IV) 780.0

(1) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)
(2) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)
(3) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)
(4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Q50.



The incorrect statements regarding enzymes are : (A) Enzymes are biocatalysts. (B) Enzymes are non-specific and can catalyse different kinds of reactions. (C) Most Enzymes are globular proteins. (D) Enzyme - oxidase catalyses the hydrolysis of maltose into glucose. Choose the correct answer from the option given below :

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

Q51. Consider the following reactions $NiS + HNO_3 + HCl \rightarrow A + NO + S + H_2O$

$A + NH_4OH + H_3C - \underset{\underset{H_3C - C = N - OH}{|}}{C} = N - OH \rightarrow B + NH_4Cl + H_2O$ The number of protons that do not involve in hydrogen bonding in the product B is _____.

Q52. For hydrogen atom, energy of an electron in first excited state is -3.4eV, K. E. of the same electron of hydrogen atom is xeV. Value of x is _____ $\times 10^{-1}$eV. (Nearest integer)

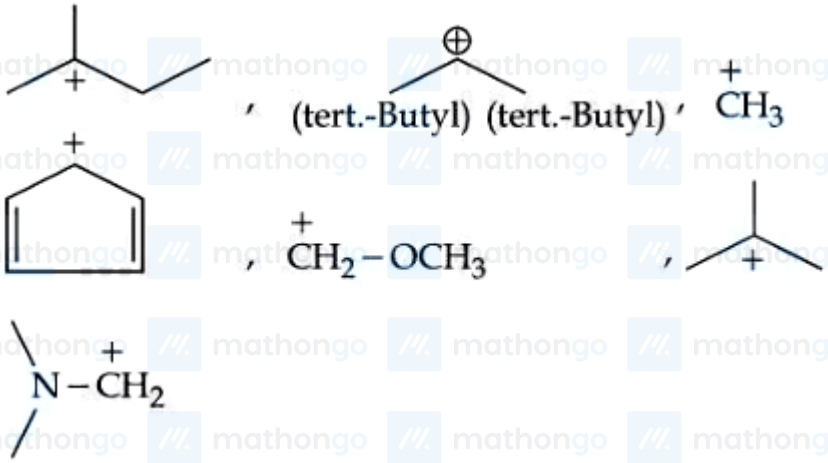
Q53. An amine (X) is prepared by ammonolysis of benzyl chloride. On adding p-toluenesulphonyl chloride to it the solution remains clear. Molar mass of the amine (X) formed is _____ gmol^{-1}. (Given molar mass in gmol^{-1} C : 12, H : 1, O : 16, N : 14)

Q54. For the reaction at 298 K, $2\ A + B \rightarrow C$. $\Delta H = 400\ \text{kJ mol}^{-1}$ and $\Delta S = 0.2\ \text{kJ mol}^{-1}\ \text{K}^{-1}$. The reaction will become spontaneous above K.

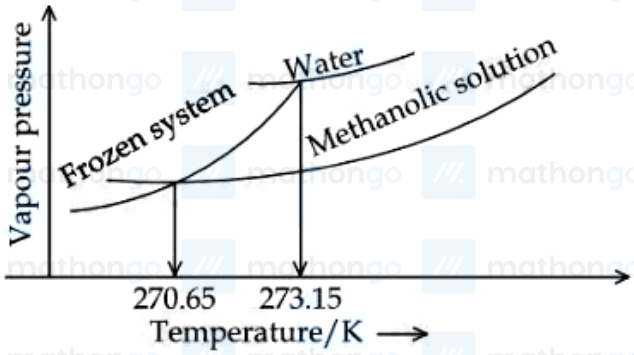
Q55. Consider the two different first order reactions given below $A + B \rightarrow C$ (Reaction 1) $P \rightarrow Q$ (Reaction 2) The ratio of the half life of Reaction 1 : Reaction 2 is 5 : 2. If t_1 and t_2 represent the time taken to complete $2/3^{\text{rd}}$ and 45^{th} of Reaction 1 and Reaction 2, respectively, then the value of the ratio $t_1 : t_2$ is _____ $\times 10^{-1}$ (nearest integer). [Given : $\log_{10}(3) = 0.477$ and $\log_{10}(5) = 0.699$]

Q56. Among VO_2^+, MnO_4^- and $Cr_2O_7^{2-}$, the spin-only magnetic moment value of the species with least oxidising ability is _____ BM (Nearest integer). (Given atomic member V = 23, Mn = 25, Cr = 24)

Q57. Number of carbocations from the following that are not stabilized by hyperconjugation is _____



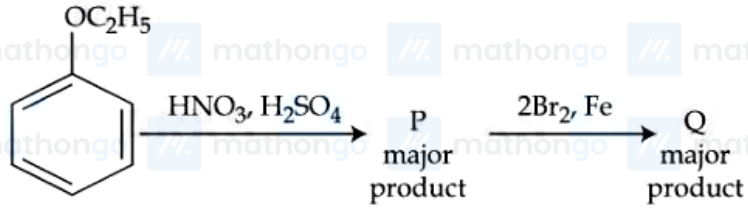
Q58. When ' x ' $\times 10^{-2}$ mL methanol (molar mass $= 32$ g; density $= 0.792$ g/cm^3) is added to 100 mL water (density $= 1$ g/cm^3), the following diagram is obtained.



$x =$ _____ (nearest integer). [Given : Molal freezing point depression constant of water at 273.15 K is 1.86 K kg mol^{-1}]

Q59. Total number of species from the following with central atom utilising sp^2 hybrid orbitals for bonding is _____. $NH_3, SO_2, SiO_2, BeCl_2, C_2H_2, C_2H_4, BCl_3, HCHO, C_6H_6, BF_3, C_2H_4Cl_2$

Q60.



The ratio of number of oxygen atoms to bromine atoms in the product Q is _____ $\times 10^{-1}$.

Q61. If z_1, z_2 are two distinct complex number such that $\left|\frac{z_1-2z_2}{\frac{1}{2}-z_1\bar{z}_2}\right| = 2$, then

(1) z_1 lies on a circle of radius $\frac{1}{2}$ and z_2 lies on a circle of radius 1 .

(2) both z_1 and z_2 lie on the same circle. both z_1 and z_2 lie on the same circle.

(3) either z_1 lies on a circle of radius $\frac{1}{2}$ or z_2 lies on a circle of radius 1 .

(4) either z_1 lies on a circle of radius 1 or z_2 lies on a circle of radius $\frac{1}{2}$.

Q62. Let $0 \leq r \leq n$. If ${}^{n+1}C_{r+1} : {}^{n}C_{r} : {}^{n-1}C_{r-1} = 55 : 35 : 21$, then $2n + 5r$ is equal to:

(1) 50 (2) 62
(3) 55 (4) 60

Q63. If all the words with or without meaning made using all the letters of the word "NAGPUR" are arranged as in a dictionary, then the word at 315^{th} position in this arrangement is :
(1) NRAGUP (2) NRAPUG
(3) NRAPGU (4) NRAGPU

Q64. Let ABC be an equilateral triangle. A new triangle is formed by joining the middle points of all sides of the triangle ABC and the same process is repeated infinitely many times. If P is the sum of perimeters and Q is be the sum of areas of all the triangles formed in this process, then :
(1) $\mathrm{P}^2 = 6\sqrt{3}\mathrm{Q}$ (2) $\mathrm{P}^2 = 36\sqrt{3}\mathrm{Q}$
(3) $\mathrm{P} = 36\sqrt{3}\mathrm{Q}^2$ (4) $\mathrm{P}^2 = 72\sqrt{3}\mathrm{Q}$

Q65. A software company sets up m number of computer systems to finish an assignment in 17 days. If 4 computer systems crashed on the start of the second day, 4 more computer systems crashed on the start of the third day and so on, then it took 8 more days to finish the assignment. The value of m is equal to:
(1) 150 (2) 180
(3) 160 (4) 125

Q66. If $\mathrm{P}(6, 1)$ be the orthocentre of the triangle whose vertices are $\mathrm{A}(5, -2), \mathrm{B}(8, 3)$ and $\mathrm{C}(\mathrm{h}, \mathrm{k})$, then the point C lies on the circle:
(1) $x^2 + y^2 - 61 = 0$ (2) $x^2 + y^2 - 52 = 0$
(3) $x^2 + y^2 - 65 = 0$ (4) $x^2 + y^2 - 74 = 0$

Q67. If the locus of the point, whose distances from the point $(2, 1)$ and $(1, 3)$ are in the ratio $5 : 4$, is $ax^2 + by^2 + cxy + dx + ey + 170 = 0$, then the value of $a^2 + 2b + 3c + 4d + e$ is equal to :
(1) 37 (2) 437
(3) -27 (4) 5

Q68. $\lim_{n\to\infty} \frac{(1^2-1)(n-1)+(2^2-2)(n-2)+\cdots+((n-1)^2-(n-1))\cdot 1}{(1^3+2^3+\cdots\cdots+n^3)-(1^2+2^2+\cdots\cdots+n^2)}$ is equal to :
(1) $\frac{2}{3}$ (2) $\frac{1}{3}$
(3) $\frac{3}{4}$ (4) $\frac{1}{2}$

Q69. Let $A = \{1, 2, 3, 4, 5\}$. Let R be a relation on A defined by $x\mathrm{R}y$ if and only if $4x \leq 5\mathrm{y}$. Let m be the number of elements in R and n be the minimum number of elements from $\mathrm{A} \times \mathrm{A}$ that are required to be added to R to make it a symmetric relation. Then $\mathrm{m} + \mathrm{n}$ is equal to :
(1) 25 (2) 24
(3) 26 (4) 23

Q70. If A is a square matrix of order 3 such that $\det(A) = 3$ and $\det\left(\operatorname{adj}\left(-4\operatorname{adj}\left(-3\operatorname{adj}\left(3\operatorname{adj}\left((2\,\mathrm{A})^{-1}\right)\right)\right)\right)\right) = 2^{\mathrm{m}}3^{\mathrm{n}}$, then $\mathrm{m} + 2\mathrm{n}$ is equal to :
(1) 2 (2) 3
(3) 6 (4) 4

Q71. Let $f(x)=\frac{1}{7-\sin 5x}$ be a function defined on $\mathbf{R}$. Then the range of the function $f(x)$ is equal to ;

(1) $\left[\frac{1}{7}, \frac{1}{6}\right]$ (2) $\left[\frac{1}{8}, \frac{1}{5}\right]$

(3) $\left[\frac{1}{7}, \frac{1}{5}\right]$ (4) $\left[\frac{1}{8}, \frac{1}{6}\right]$

Q72. Suppose for a differentiable function $h, h(0)=0, h(1)=1$ and $h'(0)=h'(1)=2$. If $\mathrm{g}(x)=h\left(\mathrm{e}^x\right) \mathrm{e}^{h(x)}$, then $g'(0)$ is equal to:

(1) 5 (2) 4

(3) 8 (4) 3

Q73. If the function $f(x)=\left(\frac{1}{x}\right)^{2x}; x>0$ attains the maximum value at $x=\frac{1}{\mathrm{e}}$ then :

(1) $\mathrm{e}^\pi<\pi^\mathrm{e}$ (2) $\mathrm{e}^\pi>\pi^\mathrm{e}$

(3) $(2e)^\pi>\pi^{(2e)}$ (4) $\mathrm{e}^{2\pi}<(2\pi)^\mathrm{e}$

Q74. If $\int \frac{1}{\mathrm{a}^2 \sin^2 x+\mathrm{b}^2 \cos^2 x} \mathrm{d}x=\frac{1}{12} \tan^{-1}(3 \tan x)+$ constant, then the maximum value of $\mathrm{a} \sin x+\mathrm{b} \cos x$, is :

(1) $\sqrt{40}$ (2) $\sqrt{41}$

(3) $\sqrt{39}$ (4) $\sqrt{42}$

Q75. If the area of the region $\left\{(x, y): \frac{\mathrm{a}}{x^2} \leq y \leq \frac{1}{x}, 1 \leq x \leq 2, 0<\mathrm{a}<1\right\}$ is $\left(\log_\mathrm{e} 2\right)-\frac{1}{7}$ then the value of $7\mathrm{a}-3$ is equal to:

(1) 0 (2) 2

(3) -1 (4) 1

Q76. Suppose the solution of the differential equation $\frac{dy}{dx}=\frac{(2+\alpha)x-\beta y+2}{\beta x-2\alpha y-(\beta\gamma-4\alpha)}$ represents a circle passing through origin. Then the radius of this circle is :

(1) 2 (2) $\sqrt{17}$

(3) $\frac{1}{2}$ (4) $\frac{\sqrt{17}}{2}$

Q77. Let $\overrightarrow{\mathrm{a}}=2\hat{i}+\hat{j}-\hat{k}, \overrightarrow{\mathrm{b}}=((\overrightarrow{\mathrm{a}} \times(\hat{i}+\hat{j})) \times \hat{i}) \times \hat{i}$. Then the square of the projection of $\overrightarrow{\mathrm{a}}$ on $\overrightarrow{\mathrm{b}}$ is :

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

(3) 2 (4) $\frac{1}{5}$

Q78. Let $\overrightarrow{\mathrm{a}}=6\hat{i}+\hat{j}-\hat{k}$ and $\overrightarrow{\mathrm{b}}=\hat{i}+\hat{j}$. If $\overrightarrow{\mathrm{c}}$ is a is vector such that $|\overrightarrow{\mathrm{c}}| \geq 6, \overrightarrow{\mathrm{a}} \cdot \overrightarrow{\mathrm{c}}=6|\overrightarrow{\mathrm{c}}|, |\overrightarrow{\mathrm{c}}-\overrightarrow{\mathrm{a}}|=2\sqrt{2}$ and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is 60°, then $|(\vec{a} \times \vec{b}) \times \vec{c}|$ is equal to:

(1) $\frac{9}{2}(6-\sqrt{6})$ (2) $\frac{3}{2}\sqrt{6}$

(3) $\frac{9}{2}(6+\sqrt{6})$ (4) $\frac{3}{2}\sqrt{3}$

Q79. Let $\mathrm{P}(\alpha, \beta, \gamma)$ be the image of the point $\mathrm{Q}(3,-3,1)$ in the line $\frac{x-0}{1}=\frac{y-3}{1}=\frac{z-1}{-1}$ and R be the point $(2,5,-1)$. If the area of the triangle PQR is λ and $\lambda^2=14K$, then K is equal to :

(1) 36 (2) 81

(3) 72 (4) 18

Q80. If three letters can be posted to any one of the 5 different addresses, then the probability that the three letters are posted to exactly two addresses is:

(1) $\frac{18}{25}$ (2) $\frac{12}{25}$
(3) $\frac{6}{25}$ (4) $\frac{4}{25}$

Q81. Let α, β be roots of $x^2+\sqrt{2}x-8=0$. If $\mathrm{U_n}=\alpha^{\mathrm{n}}+\beta^n$, then $\frac{\mathrm{U_{10}}+\sqrt{2}\mathrm{U_9}}{2\mathrm{U_8}}$ is equal to_____

Q82. If $\mathrm{S}(x)=(1+x)+2(1+x)^2+3(1+x)^3+\cdots+60(1+x)^{60}, x\neq 0$, and $(60)^2\,\mathrm{S}(60)=\mathrm{a}(\mathrm{b})^{\mathrm{b}}+\mathrm{b}$, where $a, b \in N$, then $(a+b)$ equal to _____

Q83. The length of the latus rectum and directrices of a hyperbola with eccentricity e are 9 and $x=\pm\frac{4}{\sqrt{13}}$, respectively. Let the line $y-\sqrt{3}x+\sqrt{3}=0$ touch this hyperbola at (x_0, y_0). If m is the product of the focal distances of the point (x_0, y_0), then $4\mathrm{e}^2+\mathrm{m}$ is equal to _____

Q84. In a triangle $\mathrm{ABC}, \mathrm{BC}=7, \mathrm{AC}=8, \mathrm{AB}=\alpha\in\mathrm{N}$ and $\cos\mathrm{A}=\frac{2}{3}$. If $49\cos(3\mathrm{C})+42=\frac{\mathrm{m}}{\mathrm{n}}$, where $\gcd(\mathrm{m},\mathrm{n})=1$, then $\mathrm{m}+\mathrm{n}$ is equal to_____

Q85. If the system of equations $\begin{aligned}2x+7y+\lambda z&=3\\3x+2y+5z&=4\\x+\mu y+32z&=-1\end{aligned}$ has infinitely many solutions, then $(\lambda-\mu)$ is equal to_____

Q86. Let $[\mathrm{t}]$ denote the greatest integer less than or equal to t. Let $f:[0,\infty)\to\mathbf{R}$ be a function defined by $f(x)=\left[\frac{x}{2}+3\right]-[\sqrt{x}]$. Let S be the set of all points in the interval $[0,8]$ at which f is not continuous. Then $\sum_{\mathrm{a}\in\mathrm{S}}\mathrm{a}$ is equal to _____

Q87. Let $[t]$ denote the largest integer less than or equal to t. If $\int_0^3\left([x^2]+\left[\frac{x^2}{2}\right]\right)\mathrm{d}x=\mathrm{a}+\mathrm{b}\sqrt{2}-\sqrt{3}-\sqrt{5}+\mathrm{c}\sqrt{6}-\sqrt{7}$, where $\mathrm{a},\mathrm{b},\mathrm{c}\in\mathbf{Z}$, then $\mathrm{a}+\mathrm{b}+\mathrm{c}$ is equal to_____

Q88. If the solution $y(x)$ of the given differential equation $(\mathrm{e}^y+1)\cos x\,\mathrm{d}x+\mathrm{e}^y\sin x\,\mathrm{d}y=0$ passes through the point $\left(\frac{\pi}{2},0\right)$, then the value of $\mathrm{e}^{y\left(\frac{\pi}{6}\right)}$ is equal to_____

Q89. If the shortest distance between the lines $\frac{x-\lambda}{3}=\frac{y-2}{-1}=\frac{z-1}{1}$ and $\frac{x+2}{-3}=\frac{y+5}{2}=\frac{z-4}{4}$ is $\frac{44}{\sqrt{30}}$, then the largest possible value of $|\lambda|$ is equal to _____

Q90. From a lot of 12 items containing 3 defectives, a sample of 5 items is drawn at random. Let the random variable X denote the number of defective items in the sample. Let items in the sample be drawn one by one without replacement. If variance of X is $\frac{m}{n}$, where $\gcd(m,n)=1$, then $n-m$ is equal to _____

ANSWER KEYS

1. (2)	**2.** (1)	**3.** (3)	**4.** (2)	**5.** (4)	**6.** (4)	**7.** (4)	**8.** (4)
9. (2)	**10.** (2)	**11.** (4)	**12.** (4)	**13.** (3)	**14.** (4)	**15.** (3)	**16.** (3)
17. (3)	**18.** (2)	**19.** (3)	**20.** (3)	**21.** (3)	**22.** (4)	**23.** (1)	**24.** (740)
25. (93)	**26.** (160)	**27.** (100)	**28.** (10)	**29.** (8)	**30.** (122)	**31.** (3)	**32.** (1)
33. (3)	**34.** (2)	**35.** (2)	**36.** (3)	**37.** (3)	**38.** (3)	**39.** (3)	**40.** (3)
41. (4)	**42.** (3)	**43.** (1)	**44.** (3)	**45.** (1)	**46.** (1)	**47.** (4)	**48.** (1)
49. (4)	**50.** (2)	**51.** (12)	**52.** (34)	**53.** (287)	**54.** (2000)	**55.** (17)	**56.** (0)
57. (5)	**58.** (543)	**59.** (6)	**60.** (15)	**61.** (4)	**62.** (1)	**63.** (3)	**64.** (2)
65. (1)	**66.** (3)	**67.** (1)	**68.** (2)	**69.** (1)	**70.** (4)	**71.** (4)	**72.** (2)
73. (2)	**74.** (1)	**75.** (3)	**76.** (4)	**77.** (3)	**78.** (3)	**79.** (2)	**80.** (2)
81. (4)	**82.** (3660)	**83.** (61)	**84.** (39)	**85.** (38)	**86.** (17)	**87.** (23)	**88.** (3)
89. (43)	**90.** (71)						