Q1. Statement I: If three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ are represented by three sides of a triangle and $\vec{F_1} + \vec{F_2} = -\vec{F}_3$, then these three forces are concurrent forces and satisfy the condition for equilibrium.

Statement II: A triangle made up of three forces $\vec{F_1}$, $\vec{F_2}$ and $\vec{F_3}$ as its sides were taken in the same order, satisfies the condition for translatory equilibrium.

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

Q2. Statement-I : Two forces $\vec{P} + \vec{Q}$ and $\vec{P} - \vec{Q}$ where $\vec{P} \perp \vec{Q}$, when act at an angle θ_1 each other, the magnitude of their resultant is $\sqrt{3P^2 + Q^2}$, when they act at an angle θ_2, the magnitude of their resultant becomes $\sqrt{2P^2 + Q^2}$. This is possible only when $\theta_1 < \theta_2$.

Statement-II : In the situation given above.

$\theta_1 = 60°$ and $\theta_2 = 90°$

In the light of the above statement, choose the most appropriate answer from the options given below :

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

Q3. If velocity V time T and force F are chosen as the base quantities, the dimensions of the mass will be :

(1) FVT^{-1}
(2) $FT^{-1}V^{-1}$
(3) $FT^2 \quad V$
(4) FTV^{-1}

Q4. A block moving horizontally on a smooth surface with a speed of 40 m s^{-1} splits into two parts with masses in the ratio of $1 : 2$. If the smaller part moves at 60 m s^{-1} in the same direction, then the fractional change in kinetic energy is :

(1) $\frac{1}{3}$
(2) $\frac{2}{3}$
(3) $\frac{1}{4}$
(4) $\frac{1}{8}$

Q5. A system consists of two identical spheres each of mass 1.5 kg and radius 50 cm at the ends of a light rod. The distance between the centres of the two spheres is 5 m. What will be the moment of inertia of the system about an axis perpendicular to the rod passing through its midpoint?

(1) 1.905×10^5 kg m^2
(2) 18.75 kg m^2
(3) 19.05 kg m^2
(4) 1.875×10^5 kg m^2

Q6. If R_E be the radius of Earth, then the ratio between the acceleration due to gravity at a depth r below and a height r above the earth surface is:

(Given : $r < R_E$)

(1) $1 + \frac{r}{R_E} - \frac{r^2}{R_E^2} - \frac{r^3}{R_E^3}$
(2) $1 + \frac{r}{R_E} + \frac{r^2}{R_E^2} + \frac{r^3}{R_E^3}$
(3) $1 - \frac{r}{R_E} - \frac{r^2}{R_E^2} - \frac{r^3}{R_E^3}$
(4) $1 + \frac{r}{R_E} - \frac{r^2}{R_E^2} + \frac{r^3}{R_E^3}$

Q7. Four identical hollow cylindrical columns of mild steel support a big structure of mass 50×10^3 kg. The inner and outer radii of each column are 50 cm and 100 cm respectively. Assuming uniform local distribution,

calculate the compression strain of each column.
[use $Y = 2.0 \times 10^{11}$ Pa, $g = 9.8$ m s^{-2}]
(1) 1.87×10^{-3} (2) 2.60×10^{-7}
(3) 3.60×10^{-8} (4) 7.07×10^{-4}

Q8. Two thin metallic spherical shells of radii r_1 and $r_2 r_1 < r_2$ are placed with their centres coinciding. A material of thermal conductivity K is filled in the space between the shells. The inner shell is maintained at temperature θ_1 and the outer shell at temperature $\theta_2 \theta_1 < \theta_2$. The rate at which heat flows radially through the material is :
(1) $\frac{K\theta_2 - \theta_1}{r_2 - r_1}$ (2) $\frac{K\theta_2 - \theta_1 r_2 - r_1}{4\pi r_1 r_2}$
(3) $\frac{\pi K r_1 r_2 \theta_2 - \theta_1}{r_2 - r_1}$ (4) $\frac{4\pi K r_1 r_2 \theta_2 - \theta_1}{r_2 - r_1}$

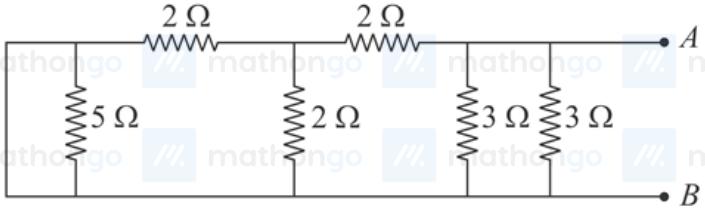
Q9. A mixture of hydrogen and oxygen has volume 500 cm^3, temperature 300 K, pressure 400 kPa and mass 0.76 g. The ratio of masses of oxygen to hydrogen will be:
(1) 16 : 3 (2) 3 : 8
(3) 8 : 3 (4) 3 : 16

Q10. A bob of mass m suspended by a thread of length ℓ undergoes simple harmonic oscillations with time period T. If the bob is immersed in a liquid that has density $\frac{1}{4}$ times that of the bob and the length of the thread is increased by $\frac{1}{3}^{rd}$ of the original length, then the time period of the simple harmonic oscillations will be:
(1) $\frac{3}{4}T$ (2) $\frac{4}{3}T$
(3) T (4) $\frac{3}{2}T$

Q11. For a body executing S.H.M. :
(a) Potential energy is always equal to its $K.E.$
(b) Average potential and kinetic energy over any given time interval are always equal.
(c) Sum of the kinetic and potential energy at any point of time is constant.
(d) Average $K.E.$ in one time period is equal to average potential energy in one time period.
Choose the most appropriate option from the options given below :
(1) (c) and (d) (2) only (c)
(3) only (b) (4) (b) and (c)

Q12. Choose the incorrect statement:
(a) The electric lines of force entering into a Gaussian surface provide negative flux.
(b) A charge q is placed at the centre of a cube. The flux through all the faces will be the same.
(c) In a uniform electric field net flux through a closed Gaussian surface containing no net charge, is zero.
(d) When an electric field is parallel to a Gaussian surface, it provides a finite non-zero flux.
Choose the most appropriate answer from the options given below:
(1) (b) and (d) Only (2) (c) and (d) Only
(3) (a) and (c) Only (4) (d) Only

Q13. The equivalent resistance of the given circuit between the terminals A and B is :



(1) $0\ \Omega$ (2) $\frac{9}{2}\ \Omega$

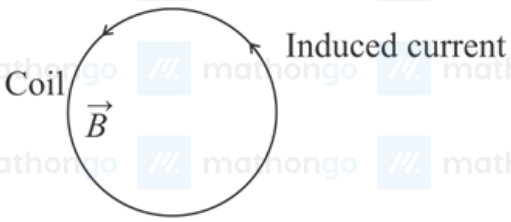
(3) $3\ \Omega$ (4) $1\ \Omega$

Q14. A current of 1.5 A is flowing through a triangle, of side 9 cm each. The magnetic field at the centroid of the triangle is :
(Assume that the current is flowing in the clockwise direction.)

(1) $2\sqrt{3}\times10^{-5}$ T, inside the plane of triangle (2) $2\sqrt{3}\times10^{-7}$ T, outside the plane of triangle

(3) 3×10^{-7} T, outside the plane of triangle (4) 3×10^{-5} T, inside the plane of triangle

Q15. A coil is placed in a magnetic field $\vec{B}$ as shown below :



A current is induced in the coil because $\vec{B}$ is :

(1) parallel to the plane of coil and increasing with time (2) outward and increasing with time

(3) outward and decreasing with time (4) parallel to the plane of coil and decreasing with time

Q16. The magnetic field vector of an electromagnetic wave is given by $B = B_0\frac{\hat{i}+\hat{j}}{\sqrt{2}}\cos kz - \omega t$ where $\hat{i}$, $\hat{j}$ represents unit vector along x and y-axis respectively. At $t = 0$ s, two electric charges q_1 of 4π coulomb and q_2 of 2π coulomb located at $0,\ 0,\ \frac{\pi}{k}$ and $0,\ 0,\ \frac{3\pi}{k}$, respectively, have the same velocity of $0.5c\hat{i}$, (where c is the velocity of light). The ratio of the force acting on charge q_1 to q_2 is :

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

(3) $\sqrt{2}\ :\ 1$ (4) $2\ :\ 1$

Q17. Consider two separate ideal gases of electrons and protons having same number of particles. The temperature of both the gases are same. The ratio of the uncertainty in determining the position of an electron to that of a proton is proportional to:

(1) $\sqrt{\frac{m_p}{m_e}}$ (2) $\frac{m_p}{m_e}$

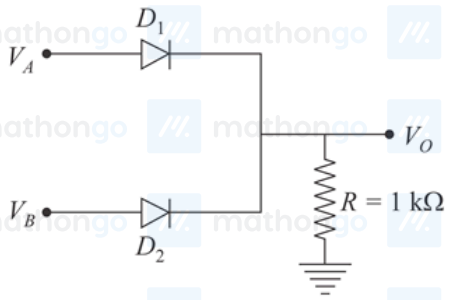
(3) $\frac{m_p}{m_e}^{\frac{3}{2}}$ (4) $\sqrt{\frac{m_e}{m_p}}$

Q18. A free electron of 2.6 eV energy collides with a H^+ ion. This results in the formation of a hydrogen atom in the first excited state and a photon is released. Find the frequency of the emitted photon. $h = 6.6 \times 10^{-34}$ J s

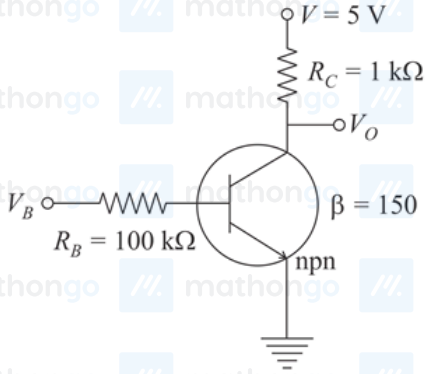
(1) 9.0×10^{27} MHz (2) 1.45×10^{9} MHz

(3) 0.19×10^{15} MHz (4) 1.45×10^{16} MHz

Q19. If V_A and V_B are the input voltages (either 5 V or 0 V) and V_0 is the output voltage then the two gates represented in the following circuits A and B are :



(A)



(B)

(1) OR and NOT Gate (2) AND and NOT Gate

(3) AND and OR Gate (4) NAND and NOR Gate

Q20. Statement I : To get a steady DC output from the pulsating voltage received from a full wave rectifier we can connect a capacitor across the output parallel to the load R_L.

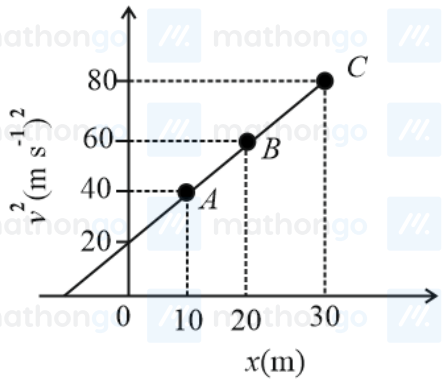
Statement II : To get a steady DC output from the pulsating voltage received from a full wave rectifier we can connect an inductor in series with R_L.

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 false (2) Both Statement I and Statement II are true

(3) Statement I is false but Statement II is true (4) Statement I is true but Statement II is false

Q21. A particle is moving with constant acceleration a. Following graph shows v^2 versus x (displacement) plot. The acceleration of the particle is _____ m s^{-2}.



Q22. A sample of gas with $\gamma = 1.5$ is taken through an adiabatic process in which the volume is compressed from 1200 cm^3 to 300 cm^3. If the initial pressure is 200 kPa. The absolute value of the workdone by the gas

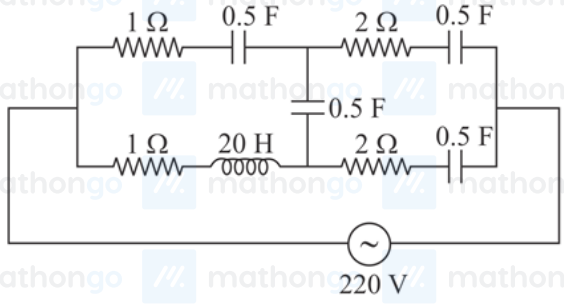
in the process $=$ _____ J.

Q23. A parallel plate capacitor of capacitance 200μF is connected to a battery of 200 V. A dielectric slab of dielectric constant 2 is now inserted into the space between plates of capacitor while the battery remain connected. The change in the electrostatic energy in the capacitor will be _____ J.

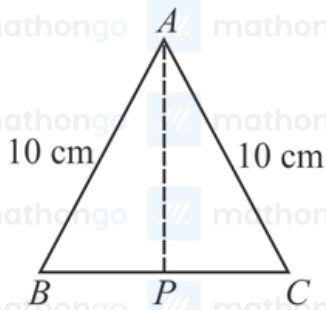
Q24. A resistor dissipates 192 J of energy in 1 s when a current of 4 A is passed through it. Now, when the current is doubled, the amount of thermal energy dissipated in 5 s is _____ J.

Q25. A long solenoid with 1000 turns m^{-1} has a core material with relative permeability 500 and volume 10^3 cm^3. If the core material is replaced by another material having relative permeability of 750 with same volume maintaining same current of 0.75 A in the solenoid, the fractional change in the magnetic moment of the core would be approximately $\frac{x}{499}$. Find the value of x.

Q26. At very high frequencies, the effective impedance of the given circuit will be _____Ω.



Q27. Cross-section view of a prism is the equilateral triangle ABC shown in the figure. The minimum deviation is observed using this prism when the angle of incidence is equal to the prism angle. The time taken by light to travel from P (midpoint of BC) to A is _____ $\times 10^{-10}$ s. (Given, speed of light in vacuum $= 3 \times 10^8$ m s^{-1} and $\cos 30° = \frac{\sqrt{3}}{2}$)



Q28. In a Young's double slit experiment, the slits are separated by 0.3 mm and the screen is 1.5 m away from the plane of slits. Distance between fourth bright fringes on both sides of central bright fringe is 2.4 cm. The frequency of light used is $x \times 10^{14}$ Hz.

Q29. A bandwidth of 6 MHz is available for $A.M.$ transmission. If the maximum audio signal frequency used for modulating the carrier wave is not to exceed 6 kHz. The number of stations that can be broadcasted within this band simultaneously without interfering with each other will be _____.

Q30. The diameter of a spherical bob is measured using a vernier callipers. 9 divisions of the main scale, in the vernier callipers, are equal to 10 divisions of vernier scale. One main scale division is 1 mm. The main scale reading is 10 mm and 8^{th} division of vernier scale was found to coincide exactly with one of the main scale division. If the given vernier callipers has positive zero error of 0.04 cm, then the radius of the bob is _____ $\times 10^{-2}$ cm.

Q31. The incorrect expression among the following is :

(1) For isothermal process $w_{reversible} = -nRT \ln\frac{V_f}{V_i}$

(2) $\ln K = \frac{\Delta H^\circ - T\Delta S^\circ}{RT}$

(3) $\frac{\Delta G_{System}}{\Delta S_{Total}} = -T$ (at constant P)

(4) $K = e^{-\Delta G^\circ / RT}$

Q32. In which one of the following sets all species show disproportionation reaction?

(1) $ClO_4^-, MnO_4^-, ClO_2^-$ and F_2

(2) $MnO_4^{2-}, ClO_2^-, Cl_2$ and Mn^{3+}

(3) $Cr_2O_7^{2-}, MnO_4^-, ClO_2^-$ and Cl_2

(4) ClO_2^-, F_2, MnO_4^- and $Cr_2O_7^{2-}$

Q33. Which one of the following statements is incorrect ?

(1) Atomic hydrogen is produced when H_2 molecules at a high temperature are irradiated with UV radiation.

(2) At around 2000 K, the dissociation of dihydrogen into its atoms is nearly 8.1%

(3) Bond dissociation enthalpy of H_2 is highest among diatomic gaseous molecules which contain a single bond.

(4) Dihydrogen is produced on reacting zinc with HCl as well as $NaOH_{(aq)}$.

Q34. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): Lithium salts are hydrated.

Reason (R) : Lithium has higher polarising power than other alkali metal group members.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) (A) is not correct but (R) is correct.

(2) (A) is correct but (R) is not correct.

(3) Both (A) and (R) are correct but (R) is NOT the correct explanation of (A).

(4) Both (A) and (R) are correct and (R) is the correct explanation of (A).

Q35. Match List - I with List - II :

List - I (Metal ion)	List - II (Group in Qualitative analysis)
(a) Mn^{2+}	(i) Group - III
(b) As^{3+}	(ii) Group - IIA
(c) Cu^{2+}	(iii) Group - IV
(d) Al^{3+}	(iv) Group - IIB

Choose the most appropriate answer from the options given below :

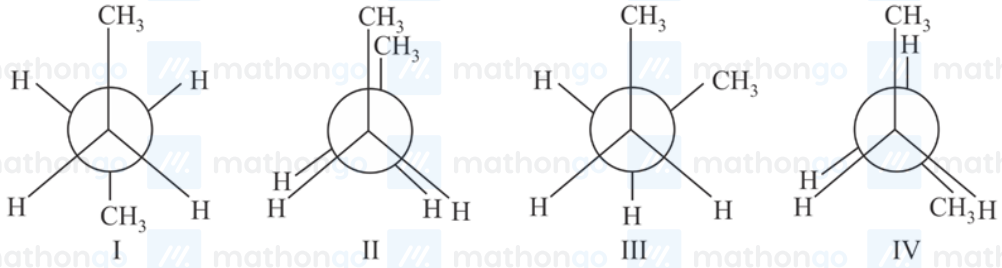
(1) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

(2) (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)

(3) (a)-(i), (b)-(iv), (c)-(ii), (d)-(iii)

(4) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

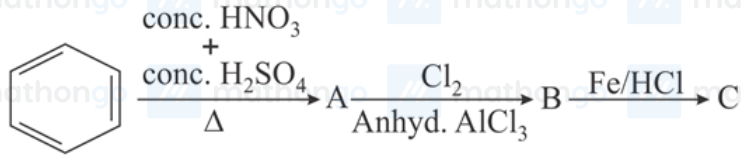
Q36. Arrange the following conformational isomers of n-butane in order of their increasing potential energy:

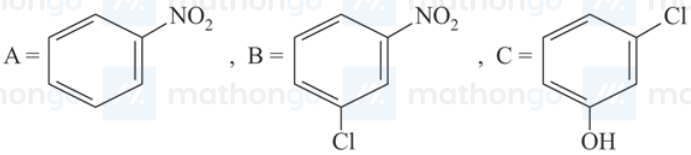


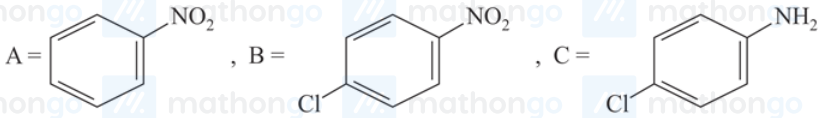
(1) I < III < IV < II (2) I < IV < III < II

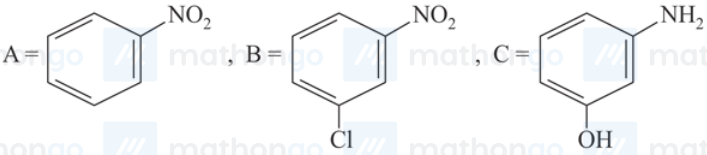
(3) II < IV < III < I (4) II < III < IV < I

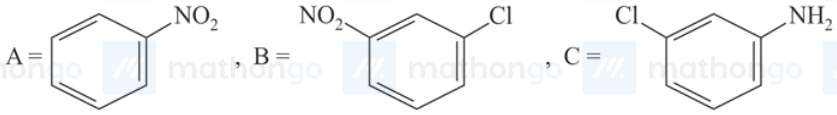
Q37. Identify correct A, B and C in the reaction sequence given below :



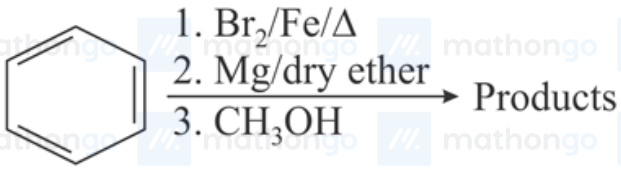
(1) 

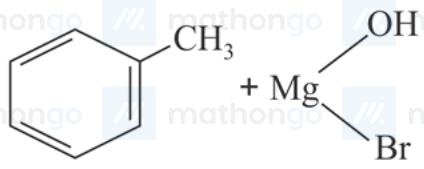
(2) 

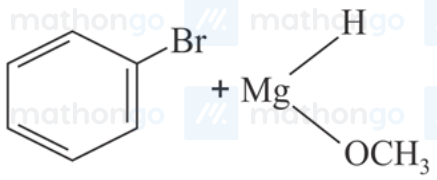
(3) 

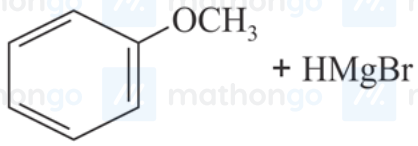
(4) 

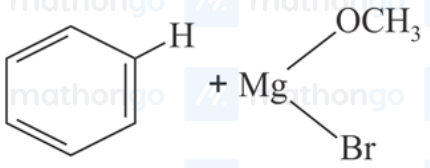
Q38. For the following sequence of reactions, the correct products are :



(1) 

(2) 

(3) 

(4) 

Q39. The deposition of X and Y on ground surfaces is referred as wet and dry depositions, respectively. X and Y are :

(1) $X = CO_2$, $Y = SO_2$

(2) X = Ammonium salts
$Y = SO_2$

(3) X = Ammonium salts$Y = CO_2$

(4) $X = SO_2$ Y = Ammonium salts

Q40. Match List - I with List - II :

List - I (Parameter)	List - II (Unit)
(a) Cell constant	(i) S cm^2 mol^{-1}
(b) Molar conductivity	(ii) Dimensionless
(c) Conductivity	(iii) m^{-1}
(d) Degree of dissociation of electrolyte	(iv) Ω^{-1} m^{-1}

(1) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

(2) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

(3) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

(4) (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

Q41. The number of $S = O$ bonds present in sulphurous acid, peroxodisulphuric acid and pyrosulphuric acid, respectively are :

(1) 1, 4 and 3

(2) 1, 4 and 4

(3) 2, 3 and 4

(4) 2, 4 and 3

Q42. Which one of the following correctly represents the order of stability of oxides, X_2O; (X = halogen) ?

(1) Cl > I > Br

(2) Br > Cl > I

(3) I > Cl > Br

(4) Br > I > Cl

Q43. The Eu^{2+} ion is a strong reducing agent in spite of its ground state electronic configuration (outermost) :
[Atomic number of Eu = 63]

(1) $4f^6 6s^2$

(2) $4f^7$

(3) $4f^7 6s^2$

(4) $4f^6$

Q44. Spin only magnetic moment in BM of $FeCO_4C_2O_4^+$ is :

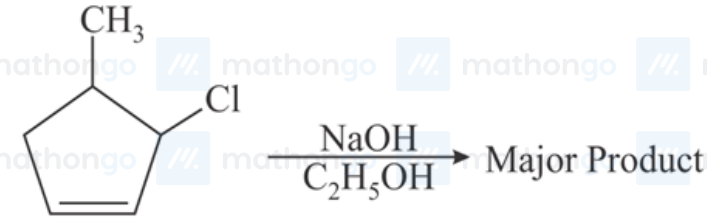
(1) 5.92

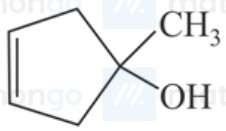
(2) 1

(3) 0

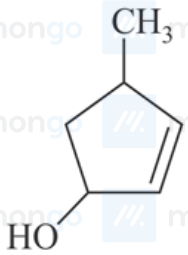
(4) 1.73

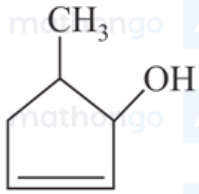
Q45. The major product of the following reaction is :



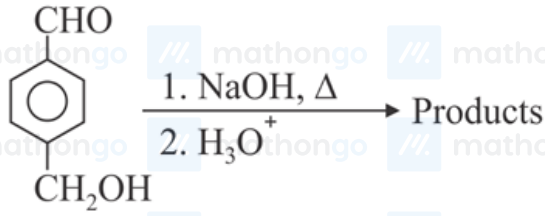
(1) 

(2) 

(3) 

(4) 

Q46. For the reaction given below :



The compound which is not formed as a product in the reaction is a :

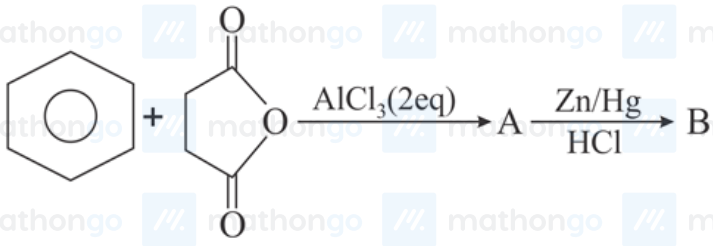
(1) diol

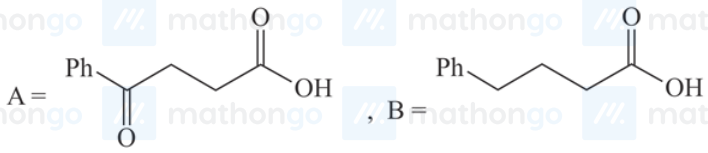
(2) monocarboxylic acid

(3) compound with both alcohol and acid functional groups

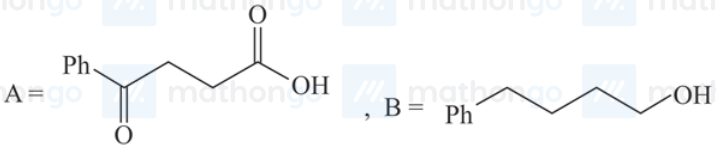
(4) dicarboxylic acid

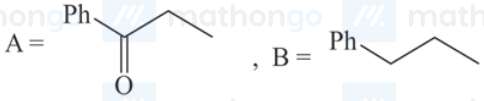
Q47. The structures of A and B formed in the following reaction are : Ph = - C_6H_5



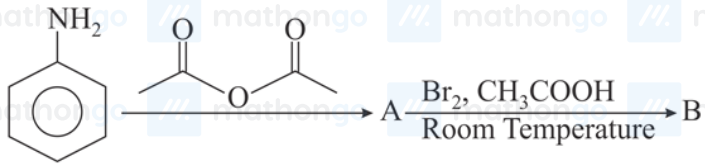
(1) 

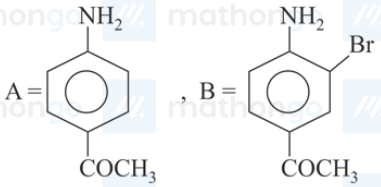
(2) 

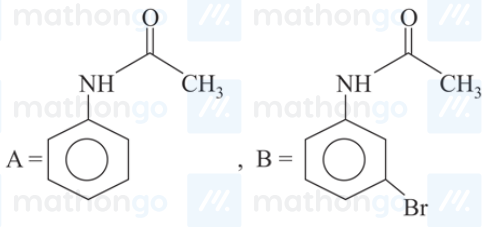
(3) 

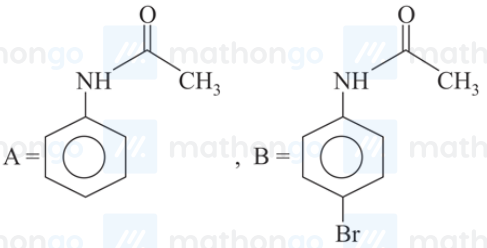
(4) 

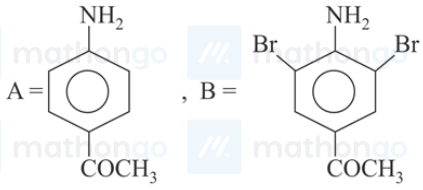
Q48. The major products A and B formed in the following reaction sequence are :



(1) 

(2) 

(3) 

(4) 

Q49. Which among the following is not a polyester ?

(1) Glyptal (2) PHBV

(3) Novolac (4) Dacron

Q50. Which of the following is NOT an example of fibrous protein ?

(1) Keratin (2) Albumin

(3) Myosin (4) Collagen

Q51. The value of magnetic quantum number of the outermost electron of Zn^{+} ion is _____ .
(Integer answer)

Q52. According to molecular orbital theory, the number of unpaired electron(s) in O_2^{2-} is _____ .

Q53. The pH of a solution obtained by mixing 50 mL of 1 M HCl and 30 mL of 1 M NaOH is $x \times 10^{-4}$. The value of x is (Nearest integer)
$\log 2.5 = 0.3979$

Q54. The transformation occurring in Duma's method is given below
$C_2H_7N + 2x + \frac{y}{2}CuO \rightarrow xCO_2 + \frac{y}{2}H_2O + \frac{z}{2}N_2 + 2x + \frac{y}{2}Cu$
The value of y is (Integer answer)

Q55. The empirical formula for a compound with a cubic close packed arrangement of anions and with cations occupying all the octahedral sites in A_xB. The value of x is (Integer answer)

Q56. Sodium oxide reacts with water to produce sodium hydroxide. 20.0 g of sodium oxide is dissolved in 500 mL of water. Neglecting the change in volume, the concentration of the resulting NaOH solution is _____ $\times 10^{-1}$M. (Nearest integer)
[Atomic mass : Na = 23.0, O = 16.0, H = 1.0]

Q57. 1.22 g of an organic acid is separately dissolved in 100 g of benzene $K_b = 2.6$ K kg mol^{-1} and 100 g of acetone $K_b = 1.7$ K kg mol^{-1}. The acid is known to dimerize in benzene but remain as a monomer in acetone. The boiling point of the solution in acetone increases by 0.17°C. The increase in boiling point of solution in benzene in°C is $x \times 10^{-2}$. The value of x is (Nearest integer)
[Atomic mass : C = 12.0, H = 1.0, O = 16.0]

Q58. For the reaction A → B, the rate constant k (in s^{-1}) is given by
$\log_{10}k = 20.35 - \frac{2.47 \times 10^3}{T}$
The energy of activation in kJ mol^{-1} is _____ . (Nearest integer)
[Given : R = 8.314 J K^{-1} mol^{-1}]

Q59. CH_4 is adsorbed on 1 g charcoal at 0°C following the Freundlich adsorption isotherm. 10.0 mL of CH_4 is adsorbed at 100 mm of Hg, whereas 15.0 mL is adsorbed at 200 mm of Hg. The volume of CH_4 adsorbed at 300 mm of Hg is 10^x mL. The value of x is _____ $\times 10^{-2}$. (Nearest integer)
[Use $\log_{10}2 = 0.3010$, $\log_{10}3 = 0.4771$]

Q60. In the electrolytic refining of blister copper, the total number of main impurities, from the following, removed as anode mud is _____ .
Pb, Sb, Se, Te, Ru, Ag, Au and Pt

Q61. The sum of the roots of the equation, $x + 1 - 2\log_2 3 + 2^x + 2\log_4 10 - 2^{-x} = 0$, is :
(1) $\log_2 14$ (2) $\log_2 12$
(3) $\log_2 13$ (4) $\log_2 11$

Q62. The number of solutions of the equation $32^{\tan^2 x} + 32^{\sec^2 x} = 81$, $0 \le x \le \frac{\pi}{4}$ is :
(1) 0 (2) 2
(3) 1 (4) 3

Q63. If z is a complex number such that $\frac{z-i}{z-1}$ is purely imaginary, then the minimum value of $|z-(3+3i)|$ is :

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

(3) $2\sqrt{2}-1$ (4) $6\sqrt{2}$

Q64. Let $a_1, a_2, a_3, \ldots$ be an A.P. If $\frac{a_1+a_2+\ldots+a_{10}}{a_1+a_2+\ldots+a_p}=\frac{100}{p^2}, p\neq 10$, then $\frac{a_{11}}{a_{10}}$ is equal to :

(1) $\frac{19}{21}$ (2) $\frac{100}{121}$

(3) $\frac{21}{19}$ (4) $\frac{121}{100}$

Q65. Let A be the set of all points α, β such that the area of triangle formed by the points $5, 6, 3, 2$ and α, β is 12 square units. Then the least possible length of a line segment joining the origin to a point in A, is :

(1) $\frac{8}{\sqrt{5}}$ (2) $\frac{12}{\sqrt{5}}$

(3) $\frac{16}{\sqrt{5}}$ (4) $\frac{4}{\sqrt{5}}$

Q66. The locus of mid-points of the line segments joining $-3, -5$ and the points on the ellipse $\frac{x^2}{4}+\frac{y^2}{9}=1$ is :

(1) $36x^2+16y^2+90x+56y+145=0$ (2) $36x^2+16y^2+108x+80y+145=0$

(3) $9x^2+4y^2+18x+8y+145=0$ (4) $36x^2+16y^2+72x+32y+145=0$

Q67. If $\alpha=\lim\limits_{x\to\pi/4}\frac{\tan^3x-\tan x}{\cos x+\frac{\pi}{4}}$ and $\beta=\lim\limits_{x\to 0}\cos x^{\cot x}$ are the roots of the equation, $ax^2+bx-4=0$, then the ordered pair a, b is :

(1) $-1, 3$ (2) $1, -3$

(3) $1, 3$ (4) $-1, -3$

Q68. Negation of the statement $(p\vee r)\Rightarrow(q\vee r)$ is :

(1) $\sim p\wedge q\wedge\sim r$ (2) $\sim p\wedge q\wedge r$

(3) $p\wedge\sim q\wedge\sim r$ (4) $p\wedge q\wedge r$

Q69. The mean and variance of 7 observations are 8 and 16 respetively. If two observations are 6 and 8, then the variance of the remaining 5 observations is :

(1) $\frac{92}{5}$ (2) $\frac{134}{5}$

(3) $\frac{112}{5}$ (4) $\frac{536}{25}$

Q70. If $\alpha+\beta+\gamma=2\pi$, then the system of equations

$x+\cos\gamma y+\cos\beta z=0$

$\cos\gamma x+y+\cos\alpha z=0$

$\cos\beta x+\cos\alpha y+z=0$

has :

(1) infinitely many solutions (2) a unique solution

(3) no solution (4) exactly two solutions

Q71. Let $f: N\to N$ be a function such that $fm+n=fm+fn$ for every $m, n\in N$. If $f6=18$ then $f2\cdot f3$ is equal to :

(1) 54 (2) 6

(3) 36 (4) 18

Q72. The domain of the function, $f(x) = \sin^{-1}\frac{3x^2+x-1}{(x-1)^2} + \cos^{-1}\frac{x-1}{x+1}$ is:

(1) $0, \frac{1}{2}$ (2) $0, \frac{1}{4}$

(3) $\frac{1}{4}, \frac{1}{2} \cup 0$ (4) $-2, 0 \cup \frac{1}{4}, \frac{1}{2}$

Q73. An angle of intersection of the curves, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and $x^2 + y^2 = ab$, $a > b$, is :

(1) $\tan^{-1}2\sqrt{ab}$ (2) $\tan^{-1}\frac{a+b}{\sqrt{ab}}$

(3) $\tan^{-1}\frac{a-b}{\sqrt{ab}}$ (4) $\tan^{-1}\frac{a-b}{2\sqrt{ab}}$

Q74. Let f be any continuous function on $0, 2$ and twice differentiable on $0, 2$. If $f0 = 0$, $f1 = 1$ and $f2 = 2$, then :

(1) $f''x > 0$ for all $x \in 0, 2$ (2) $f'x = 0$ for some $x \in 0, 2$

(3) $f''x = 0$ for some $x \in 0, 2$ (4) $f''x = 0$ for all $x \in 0, 2$

Q75. If x is the greatest integer $\leq x$, then $\pi^2 \int_0^2 \sin\frac{\pi x}{2} x - x^{[x]} dx$ is equal to :

(1) $2(\pi + 1)$ (2) $4(\pi - 1)$

(3) $2(\pi - 1)$ (4) $4(\pi + 1)$

Q76. If $y\frac{dy}{dx} = x\frac{y^2}{x^2} + \frac{\phi\frac{y^2}{x^2}}{\phi'\frac{y^2}{x^2}}$, $x > 0$, $\phi > 0$, and $y(1) = -1$, then $\phi\frac{y^2}{4}$ is equal to:

(1) $2\phi 1$ (2) $\phi 1$

(3) $4\phi 2$ (4) $4\phi 1$

Q77. If $\frac{dy}{dx} = \frac{2^x y + 2^y \cdot 2^x}{2^x + 2^{x+y}\log_e 2}$, $y0 = 0$, then for $y = 1$, the value of x lies in the interval :

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

(3) $2, 3$ (4) $0, \frac{1}{2}$

Q78. Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three vectors mutually perpendicular to each other and have same magnitude. If a vector $\vec{r}$ satisfies $\vec{a} \times \{\vec{r} - \vec{b} \times \vec{a}\} + \vec{b} \times \{\vec{r} - \vec{c} \times \vec{b}\} + \vec{c} \times \{\vec{r} - \vec{a} \times \vec{c}\} = \vec{0}$, then $\vec{r}$ is equal to:

(1) $\frac{1}{3}(\vec{a} + \vec{b} + \vec{c})$ (2) $\frac{1}{3}(2\vec{a} + \vec{b} - \vec{c})$

(3) $\frac{1}{2}(\vec{a} + \vec{b} + \vec{c})$ (4) $\frac{1}{2}(\vec{a} + \vec{b} + 2\vec{c})$

Q79. The distance of the point $(-1, 2, -2)$ from the line of intersection of the planes $2x + 3y + 2z = 0$ and $x - 2y + z = 0$ is :

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{\sqrt{42}}{2}$

(3) $\frac{5}{2}$ (4) $\frac{\sqrt{34}}{2}$

Q80. Let $S = \{1, 2, 3, 4, 5, 6\}$. Then the probability that a randomly chosen onto function g from S to S satisfies $g3 = 2$ $g1$ is :

(1) $\frac{1}{15}$ (2) $\frac{1}{5}$

(3) $\frac{1}{30}$ (4) $\frac{1}{10}$

Q81. The number of 4-digit numbers which are neither multiple of 7 nor multiple of 3 is _____ .

Q82. If $S = \frac{7}{5} + \frac{9}{5^2} + \frac{13}{5^3} + \frac{19}{5^4} + \ldots$, then $160\ S$ is equal to _____.

Q83. If the coefficient of a^7b^8 in the expansion of $(a + 2b + 4ab)^{10}$ is $K \cdot 2^{16}$, then K is equal to

Q84. Let B be the centre of the circle $x^2 + y^2 - 2x + 4y + 1 = 0$. Let the tangents at two points P and Q on the circle intersect at the point $A(3, 1)$. Then $8\frac{\text{area } \Delta APQ}{\text{area } \Delta BPQ}$ is equal to _____.

Q85. A tangent line L is drawn at the point $(2, -4)$ on the parabola $y^2 = 8x$. If the line L is also tangent to the circle $x^2 + y^2 = a$, then a is equal to _____.

Q86. The number of elements in the set $\{A = \begin{matrix} a & b \\ 0 & d \end{matrix} : a, b, d \in \{-1, 0, 1\}$ and $(I - A)^3 = I - A^3\}$, where I is 2×2 identity matrix, is _____.

Q87. Let $f(x)$ be a cubic polynomial with $f(1) = -10$, $f(-1) = 6$, and has a local minima at $x = 1$, and $f'(x)$ has a local minima at $x = -1$. Then $f(3)$ is equal to _____.

Q88. If $\int \frac{\sin x}{\sin^3 x + \cos^3 x}\, dx = \alpha \log_e |1 + \tan x| + \beta \log_e (1 - \tan x + \tan^2 x) + \gamma \tan^{-1}\frac{2\tan x - 1}{\sqrt{3}} + C$, when C is constant of integration, then the value of $18\alpha + \beta + \gamma^2$ is

Q89. If the line $y = mx$ bisects the area enclosed by the lines $x = 0$, $y = 0$, $x = \frac{3}{2}$ and the curve $y = 1 + 4x - x^2$, then $12m$ is equal to _____.

Q90. Suppose the line $\frac{x-2}{\alpha} = \frac{y-2}{-5} = \frac{z+2}{2}$ lies on the plane $x + 3y - 2z + \beta = 0$. Then $(\alpha + \beta)$ is equal to _____.

ANSWER KEYS

1. (1)	**2.** (2)	**3.** (4)	**4.** (4)	**5.** (3)	**6.** (1)	**7.** (2)	**8.** (4)
9. (1)	**10.** (2)	**11.** (1)	**12.** (4)	**13.** (4)	**14.** (4)	**15.** (3)	**16.** (4)
17. (1)	**18.** (2)	**19.** (1)	**20.** (2)	**21.** (1)	**22.** (480)	**23.** (4)	**24.** (3840)
25. (250)	**26.** (2)	**27.** (5)	**28.** (5)	**29.** (500)	**30.** (52)	**31.** (2)	**32.** (2)
33. (2)	**34.** (3)	**35.** (1)	**36.** (1)	**37.** (4)	**38.** (4)	**39.** (2)	**40.** (1)
41. (2)	**42.** (3)	**43.** (2)	**44.** (4)	**45.** (2)	**46.** (4)	**47.** (1)	**48.** (3)
49. (3)	**50.** (2)	**51.** (0)	**52.** (0)	**53.** (6021)	**54.** (7)	**55.** (1)	**56.** (13)
57. (13)	**58.** (47)	**59.** (128)	**60.** (6)	**61.** (4)	**62.** (3)	**63.** (2)	**64.** (3)
65. (1)	**66.** (2)	**67.** (3)	**68.** (3)	**69.** (4)	**70.** (1)	**71.** (1)	**72.** (3)
73. (3)	**74.** (3)	**75.** (2)	**76.** (4)	**77.** (1)	**78.** (3)	**79.** (4)	**80.** (4)
81. (5143)	**82.** (305)	**83.** (315)	**84.** (18)	**85.** (2)	**86.** (8)	**87.** (22)	**88.** (3)
89. (26)	**90.** (7)						