**Q1.** The velocity of a particle is $\mathrm{v} = \mathrm{v}_0 + \mathrm{gt} + \mathrm{ft}^2$. If its position is $\mathrm{x} = 0$ at $\mathrm{t} = 0$, then its displacement after unit time $(t = 1)$ is

(1) $\mathrm{v}_0 + 2\mathrm{g} + 3\mathrm{f}$ (2) $\mathrm{v}_0 + \mathrm{g}/2 + \mathrm{f}/3$

(3) $\mathrm{v}_0 + \mathrm{g} + \mathrm{f}$ (4) $\mathrm{v}_0 + \mathrm{g}/2 + \mathrm{f}$

**Q2.** A particle is projected at $60^\circ$ to the horizontal with a kinetic energy K. The kinetic energy at the highest point is

(1) K (2) Zero

(3) $\mathrm{K}/2$ (4) $\mathrm{K}/4$

**Q3.** A particle just clears a wall of height $b$ at distance $a$ and strikes the ground at a distance $c$ from the point of projection. The angle of projection is

(1) $\tan^{-1}\frac{b}{ac}$ (2) $45^\circ$

(3) $\tan^{-1}\frac{bc}{a(c-a)}$ (4) $\tan^{-1}\frac{bc}{a}$

**Q4.** A block of mass ' m ' is connected to another block of mass ' M ' by a spring (massless) of spring constant ' k '. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the spring is unstretched. Then a constant force 'F' starts acting on the block of mass 'M' to pull it. Find the force on the block of mass 'm'

(1) $\frac{\mathrm{mF}}{\mathrm{M}}$ (2) $\frac{(\mathrm{M+m})\mathrm{F}}{\mathrm{m}}$

(3) $\frac{\mathrm{mF}}{(\mathrm{m+M})}$ (4) $\frac{\mathrm{MF}}{(\mathrm{m+M})}$

**Q5.** A 2 kg block slides on a horizontal floor with a speed of 4 m/s. It strikes a uncompressed spring, and compresses it till the block is motionless. The kinetic friction force is 15 N and spring constant is $10,000.\ \mathrm{N/m}$. The spring compresses by

(1) 5.5 cm (2) 2.5 cm

(3) 11.0 cm (4) 8.5 cm

**Q6.** A body weighing 13 kg is suspended by two strings 5 m and 12 m long, their other ends being fastened to the extremities of a rod 13 m long. If the rod be so held that the body hangs immediately below the middle point. The tensions in the strings are

(1) 12 kg and 13 kg (2) 5 kg and 5 kg

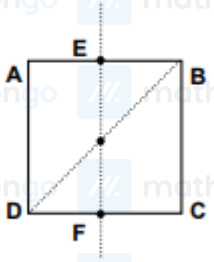
(3) 5 kg and 12 kg (4) 5 kg and 13 kg

**Q7.** A circular disc of radius R is removed from a bigger circular disc of radius 2R such that the circumferences of the discs coincide. The centre of mass of the new disc is $\alpha/\mathrm{R}$ from the centre of the bigger disc. The value of $\alpha$ is

(1) $1/3$ (2) $1/2$

(3) $1/6$ (4) $1/4$

**Q8.**




For the given uniform square lamina ABCD, whose centre is O,

(1) $\sqrt{2}I_{AC} = I_{EF}$ (2) $I_{AD} = 3I_{EF}$

(3) $I_{AC} = I_{EF}$ (4) $I_{AC} = \sqrt{2}I_{EF}$

**Q9.** A round uniform body of radius R, mass M and moment of inertia 'I', rolls down (without slipping) an inclined plane making an angle $\theta$ with the horizontal. Then its acceleration is

(1) $\frac{g\sin\theta}{1+\frac{I}{MR^2}}$ (2) $\frac{g\sin\theta}{1+\frac{MR^2}{I}}$

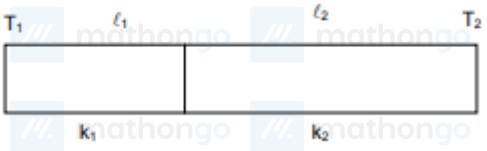
(3) $\frac{g\sin\theta}{1-\frac{I}{MR^2}}$ (4) $\frac{g\sin\theta}{1-\frac{MR^2}{I}}$

**Q10.** Angular momentum of the particle rotating with a central force is constant due to

(1) Constant Force (2) Constant linear momentum.

(3) Zero Torque (4) Constant Torque

**Q11.** One end of a thermally insulated rod is kept at a temperature $T_1$ and the other at $T_2$. The rod is composed of two sections of lengths $\ell_1$ and $\ell_2$ and thermal conductivities $k_1$ and $k_2$ respectively. The temperature at the




interface of the two sections is

(1) $(k_2\ell_2T_1 + k_1\ell_1T_2)/(k_1\ell_1 + k_2\ell_2)$ (2) $(k_2\ell_1T_1 + k_1\ell_1T_2)/(k_2\ell_1 + k_1\ell_2)$

(3) $(k_1\ell_2T_1 + k_2\ell_1T_2)/(k_1\ell_2 + k_2\ell_1)$ (4) $(k_1\ell_1T_1 + k_2\ell_2T_2)/(k_1\ell_1 + k_2\ell_2)$

**Q12.** A Carnot engine, having an efficiency of $\eta = 1/10$ as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is

(1) 99 J (2) 90 J

(3) 1 J (4) 100 J

**Q13.** When a system is taken from state $i$ to state $f$ along the path iaf, it is found that $Q = 50$ cal and $W = 20$ cal.


Along the path' ibf $Q = 36$ cal. W along the path ibf is

(1) 6 cal (2) 16 cal.

(3) 66 cal. (4) 14 cal.

**Q14.** If $C_p$ and $C_v$ denote the specific heats of nitrogen per unit mass at constant pressure and constant volume respectively, then

(1) $C_p - C_v = R/28$ (2) $C_p - C_v = R/14$

(3) $C_p - C_v = R$ (4) $C_p - C_v = 28R$

**Q15.** The displacement of an object attached to a spring and executing simple harmonic motion is given by $x = 2 \times 10^{-2} \cos \pi t$ metres. The time at which the maximum speed first occurs is

(1) 0.5 s (2) 0.75 s

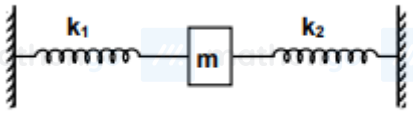
(3) 0.125 s (4) 0.25 s

**Q16.** A point mass oscillates along the $x$-axis according to the law $x = x_0 \cos(\omega t - \pi/4)$. If the acceleration of the particle is written as $a = A \cos(\omega t + \delta)$

(1) $A = x_0, \delta = -\pi/4$ (2) $A = x_0\omega^2, \delta = -\pi/4$

(3) $A = x_0\omega^2, \delta = -\pi/4$ (4) $A = x_0\omega^2, \delta = 3\pi/4$

**Q17.** Two springs, of force constants $k_1$ and $k_2$, are connected to a mass m as shown. The frequency of oscillation of the mass is f. If both $k_1$ and $k_2$ are made four times their original values, the frequency of oscillation becomes




(1) $f/2$ (2) $f/4$

(3) $4f$ (4) $2f$

**Q18.** A particle of mass $m$ executes simple harmonic motion with amplitude ' $a$ ' and frequency ' $v$ '. The average kinetic energy during its motion from the position of equilibrium to the end is

(1) $\pi^2 m a^2 v^2$ (2) $\frac{1}{4}\pi^2 m a^2 v^2$

(3) $4\pi^2 m a^2 v^2$ (4) $2\pi^2 m a^2 v^2$

**Q19.** A sound absorber attenuates the sound level by 20 dB. The intensity decreases by a factor of

(1) 1000 (2) 10000

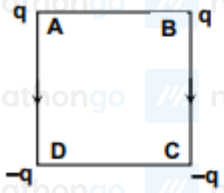
(3) 10 (4) 100

**Q20.** An electric charge $10^{-3}\mu C$ is placed at the origin $(0, 0)$ of $X - Y$ co-ordinate system. Two points $A$ and B are situated at $(\sqrt{2}, \sqrt{2})$ and $(2, 0)$ respectively. The potential difference between the points $A$ and $B$ will be

(1) 9 volt (2) zero

(3) 2 volt (4) 4.5 volt

**Q21.** Charges are placed on the vertices of a square as shown. Let E be the electric field and V the potential at the centre. If the charges on A and B are interchanged with those on D and C respectively, then




(1) $\vec{E}$ remains unchanged, V changes
(2) Both $\vec{E}$ and V change
(3) $\vec{E}$ and V remains unchanged
(4) $\vec{E}$ changes, V remains unchanged

**Q22.** The potential at a point $x$ (measured in $\mu$m ) due to some charges situated on the x-axis is given by $V(x) = 20/\left(x^2 - 4\right)$ Volts. The electric field E at $x = 4$ $\mu$m is given by
(1) $5/3$ Volt/ $\mu$m and in the $-ve$ $x$ direction
(2) $5/3$ Volt/ $\mu$m and in the $+ve$ $x$ direction.
(3) $10/9$ Volt/$\mu$m and in the $-ve$ $x$ direction
(4) $10/9$ Volt/$\mu$m and in the $+ve$ $x$ direction.

**Q23.** If $g_E$ and $g_m$ are the accelerations due to gravity on the surfaces of the earth and the moon respectively and if Millikan's oil drop experiment could be performed on the two surfaces, one will find the ratio $\frac{\text{electronic charge on the moon}}{\text{electronic charge on the earth}}$ to be
(1) 1
(2) 0
(3) $g_E/g_m$
(4) $g_m$ / $g_E$

**Q24.** A battery is used to charge a parallel plate capacitor till the potential difference between the plates becomes equal to the electromotive force of the battery. The ratio of the energy stored in the capacitor and the work done by the battery will be
(1) 1
(2) 2
(3) $\frac{1}{4}$
(4) $\frac{1}{2}$

**Q25.** A parallel plate condenser with a dielectric of dielectric constant K between the plates has a capacity C and is charged to a potential V volts. The dielectric slab is slowly removed from between the plates and then reinserted. The net work done by the system in this process is
(1) $1/2(K-1)CV^2$
(2) $CV^2(K-1)/K$
(3) $(K-1)CV^2$
(4) zero

**Q26.** The resistance of a wire is 5 ohm at 50°C and 6 ohm at 100°C. The resistance of the wire at 0°C will be
(1) 2 ohm
(2) 1 ohm
(3) 4 ohm
(4) 3 ohm

**Q27.** A long straight wire of radius ' $a$ ' caries a steady current i. The current is uniformly distributed across its cross section. The ratio of the magnetic field at $\frac{a}{2}$ and $2a$ is
(1) $\frac{1}{4}$
(2) 4
(3) 1
(4) $\frac{1}{2}$

**Q28.** A current I flows along the length of an infinitely long, straight, thin walled pipe. Then

(1) the magnetic field is zero only on the axis of the pipe
(2) the magnetic field is different at different points inside the pipe
(3) the magnetic field at any point inside the pipe is zero
(4) the magnetic field at all points inside the pipe is the same, but not zero

**Q29.** A charged particle with charge q enters a region of constant, uniform and mutually orthogonal fields $\vec{E}$ and $\vec{B}$ with a velocity $\vec{v}$ perpendicular to both $\vec{E}$ and $\vec{B}$, and comes out without any change in magnitude or direction of $\vec{v}$. Then
(1) $\vec{v} = \vec{E} \times \vec{B}/B^2$
(2) $\vec{v} = \vec{B} \times \vec{E}/B^2$
(3) $\vec{v} = \vec{E} \times \vec{B}/E^2$
(4) $\overrightarrow{v} = \overrightarrow{B} \times \overrightarrow{E}/E^2$

**Q30.** A charged particle moves through a magnetic field perpendicular to its direction. Then
(1) the momentum changes but the kinetic energy is constant
(2) both momentum and kinetic energy of the particle are not constant
(3) both, momentum and kinetic energy of the particle are constant
(4) kinetic energy changes but the momentum is constant

**Q31.** Two identical conducting wires AOB and COD are placed at right angles to each other. The wire AOB carries an electric current $I_1$ and COD carries a current $I_2$. The magnetic field on a point lying at a distance ' d ' from O, in a direction perpendicular to the plane of the wires AOB and COD, will be given by
(1) $\frac{\mu_0}{2\pi}\left(\frac{I_1+I_2}{d}\right)^{1/2}$
(2) $\frac{\mu_0}{2\pi d}\left(I_1^2+I_2^2\right)^{1/2}$
(3) $\frac{\mu_0}{2\pi d}(I_1+I_2)$
(4) $\frac{\mu_0}{2\pi d}\left(I_1^2+I_2^2\right)$

**Q32.** An ideal coil of 10H is connected in series with a resistance of 5Ω and a battery of 5 V. 2 second after the connection is made the current flowing in amperes in the circuit is
(1) $(1-e)$
(2) e
(3) $e^{-1}$
(4) $\left(1-e^{-1}\right)$

**Q33.** In an a.c. circuit the voltage applied is $E = E_0 \sin \omega t$. The resulting current in the circuit is $I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$. The power consumption in the circuit is given by
(1) $P = \frac{E_0 I_0}{\sqrt{2}}$
(2) P = zero
(3) $P = \frac{E_0 I_0}{2}$
(4) $P\sqrt{2}E_0 I_0$

**Q34.** Two lenses of power $-15$ D and $+5$ D are in contact with each other. The focal length of the combination is
(1) $-20$ cm
(2) $-10$ cm
(3) $+20$ cm
(4) $+10$ cm

**Q35.** In a Young's double slit experiment the intensity at a point where the path difference is $\frac{\lambda}{6}$ ($\lambda$ being the wavelength of the light used) is I. If $I_0$ denotes the maximum intensity, $\frac{I}{I_0}$ is equal to
(1) $\frac{1}{\sqrt{2}}$
(2) $\frac{\sqrt{3}}{2}$
(3) $1/2$
(4) $3/4$

**Q36.** Photon of frequency v has a momentum associated with it. If c is the velocity of light, the momentum is

(1) $v/c$
(2) $hvc$
(3) $hv/c^2$
(4) $hv/c$

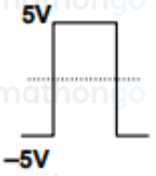
**Q37.** Which of the following transitions in hydrogen atoms emit photons of highest frequency?
(1) $n = 2$ to $n = 6$
(2) $n = 6$ to $n = 2$
(3) $n = 2$ to $n = 1$
(4) $n = 1$ to $n = 2$

**Q38.** If $M_o$ is the mass of an oxygen isotope ${}_8O^{17}$, $M_p$ and $M_N$ are the masses of a proton and a neutron respectively, the nuclear binding energy of the isotope is
(1) $(M_o - 8M_p)C^2$
(2) $(M_o - 8M_p - 9M_N)C^2$
(3) $M_oC^2$
(4) $(M_o - 17M_N)C^2$

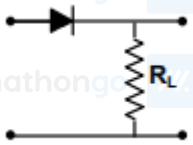
**Q39.** In gamma ray emission from a nucleus
(1) both the neutron number and the proton number change
(2) there is no change in the proton number and the neutron number.
(3) only the neutron number changes
(4) only the proton number changes

**Q40.** The half-life period of a radio-active element X is same as the mean life time of another radioactive element Y . Initially they have the same number of atoms. Then
(1) X will decay faster than Y
(2) Y will decay faster than X
(3) X and Y have same decay rate initially
(4) X and Y decay at same rate always.

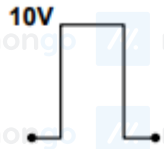
**Q41.**

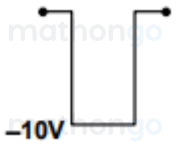



If in a p – n junction diode, a square input signal of 10 V is applied as shown

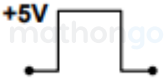



Then the output signal across $R_L$ will be

(1) 


(2) 


(3) 


(4) 


**Q42.** Carbon, silicon and germanium have four valence electrons each. At room temperature which one of the following statements is most appropriate?

(1) The number of free conduction electrons is significant in C but small in Si and Ge.
(2) The number of free conduction electrons is negligible small in all the three.
(3) The number of free electrons for conduction is significant in all the three.
(4) The number of free electrons for conduction is significant only in Si and Ge but small in C.

**Q43.** The density (in g $mL^{-1}$) of a 3.60 M sulphuric acid solution that is 29% $H_2SO_4$ (Molar mass = 98 g $mol^{-1}$) by mass will be
(1) 1.64
(2) 1.88
(3) 1.22
(4) 1.45

**Q44.** Which of the following sets of quantum numbers represents the highest energy of an atom?
(1) $n = 3,\ l = 2,\ m = 1,\ s = +1/2$
(2) $n = 3,\ l = 2,\ m = 1,\ s = +1/2$
(3) $n = 4,\ l = 0,\ m = 0,\ s = +1/2$
(4) $n = 3,\ l = 0,\ m = 0,\ s = +1/2$

**Q45.** The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence
(1) $GeX_2 \ll SiX_2 \ll SnX_2 \ll PbX_2$
(2) $SiX_2 \ll GeX_2 \ll PbX_2 \ll SnX_2$
(3) $SiX_2 \ll GeX_2 \ll SnX_2 \ll PbX_2$
(4) $PbX_2 \ll SnX_2 \ll GeX_2 \ll SiX_2$

**Q46.** In which of the following ionization processes, the bond order has increased and the magnetic behaviour has changed?
(1) $C_2 \longrightarrow C_2^+$
(2) $NO \longrightarrow NO^+$
(3) $O_2 \longrightarrow O_2^+$
(4) $N_2 \longrightarrow N_2^+$

**Q47.** Which of the following hydrogen bonds is the strongest?
(1) $O - H \ldots\ldots N$
(2) $F - H \ldots\ldots F$
(3) $O - H \ldots\ldots O$
(4) $O - H \ldots\ldots F$

**Q48.** Which of the following species exhibits the diamagnetic behaviour?
(1) $O_2^{2-}$
(2) $O_2^+$
(3) $O_2$
(4) NO

**Q49.** The charge/size ratio of a cation determines its polarizing power. Which one of the following sequences represents the increasing order of the polarizinig order of the polarizing power of the cationic species, $K^+, Ca^{2+}, Mg^{2+}, Be^{2+}$ ?
(1) $Mg^{2+}, Be^{2+}, K^+, Ca^{2+}$
(2) $Be^{2+}, K^+, Ca^{2+}, Mg^{2+}$
(3) $K^+, Ca^{2+}, Mg^{2+}, Be^{2+}$
(4) $Ca^{2+}, Mg^{2+}, Be^{2+}, K^+$

**Q50.** Equal masses of methane and oxygen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by oxygen is
(1) $\frac{2}{3}$
(2) $\frac{1}{3} \times \frac{273}{298}$
(3) $\frac{1}{3}$
(4) $\frac{1}{2}$

**Q51.** A 5.25% solution of a substance is isotonic with a 1.5% solution of urea ( molar mass = 60 g $mol^{-1}$ ) in the same solvent. If the densities of both the solutions are assumed to be equal to 1.0 g $cm^{-3}$, molar mass of the substance will be

(1) $90.0\ \text{g mol}^{-1}$ (2) $115.0\ \text{g mol}^{-1}$
(3) $105.0\ \text{g mol}^{-1}$ (4) $210.0\ \text{g mol}^{-1}$

**Q52.** In the reaction. $2\text{Al}_{(s)} + 6\text{HCl}_{(s)} \longrightarrow 2\text{Al}^{3+}_{(aq)} + 6\text{Cl}^{-}_{(aq)} + 3\text{H}_{2(g)}$,
(1) 6 L $\text{HCl}_{(aq)}$ is consumed for every 3 L $\text{H}_{2(g)}$ produced
(2) 33.6 L $\text{H}_{2(g)}$ is produced regardless of temperature and pressure for every mole Al that reacts
(3) 67.2 L $\text{H}_{2(g)}$ at STP is produced for every mole Al that reacts
(4) 11.2 $\text{H}_{2(g)}$ at STP is produced for every mole $\text{HCl}_{(aq)}$ consumed

**Q53.** Assuming that water vapour is an ideal gas, the internal energy $(\Delta \text{U})$ when 1 mol of water is vapourised at 1 bar pressure and 100°C, (Given: Molar enthalpy of vapourization of water at 1 bar and $373\ \text{K} = 41\ \text{kJ mol}^{-1}$ and $\text{R} = 8.3\ \text{J mol}^{-1}\ \text{K}^{-1}$ ) will be
(1) $4.100\ \text{kJ mol}^{-1}$ (2) $3.7904\ \text{kJ mol}^{-1}$
(3) $37.904\ \text{kJ mol}^{-1}$ (4) $41.00\ \text{kJ mol}^{-1}$

**Q54.** Identify the correct statement regarding a spontaneous process
(1) For a spontaneous process in an isolated system, the change in entropy is positive
(2) Endothermic processes are never spontaneous
(3) Exothermic processes are always spontaneous
(4) Lowering of energy in the reaction process is the only criterion for spontaneity

**Q55.** In conversion of lime-stone to lime, $\text{CaCO}_3(\text{ s}) \longrightarrow \text{CaO(s)} + \text{CO}_2(\text{ g})$ the vales of $\Delta \text{H}^\circ$ and $\Delta \text{S}^\circ$ are $+179.1\ \text{kJ mol}^{-1}$ and $160.2\ \text{J/K}$ respectively at 298 K and 1 bar. Assuming that $\Delta \text{H}^\circ$ do not change with temperature, temperature above which conversion of limestone to lime will be spontaneous is
(1) 1008 K (2) 1200
(3) 845 K (4) 1118 K

**Q56.** The pKa of a weak acid $(\text{HA})$ is 4.5. The pOH of an aqueous buffered solution of HA in which 50% of the acid is ionized is
(1) 4.5 (2) 2.5
(3) 9.5 (4) 7.0

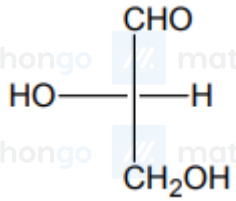
**Q57.** In a sautrated solution of the sparingly soluble strong electrolyte $\text{AgIO}_3$ (Molecular mass = 283) the equilibrium which sets in is $\text{AgIO}_{3(s)} \rightleftharpoons \text{Ag}^{+}_{(aq)} + \text{IO}^{-}_{3(aq)}$ If the solubility product constant $\text{K}_{sp}$ of $\text{AgIO}_3$ at a given temperature is $1.0 \times 10^{-8}$, what is the mass of $\text{AgIO}_3$ contained in 100 ml of its saturated solution?
(1) $28.3 \times 10^{-2}$ g (2) $2.83 \times 10^{-3}$ g
(3) $1.0 \times 10^{-7}$ g (4) $1.0 \times 10^{-4}$ g

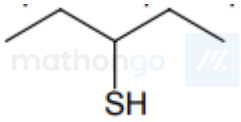
**Q58.** Regular use of which of the following fertilizer increases the acidity of soil?
(1) Potassium nitrate (2) Urea
(3) Superphosphate of lime (4) Ammonium sulphate

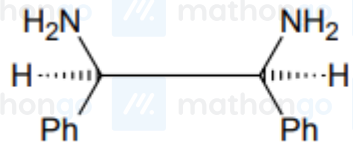
**Q59.** The first and second dissociation constants of an acid $\text{H}_2\text{A}$ are $1.0 \times 10^{-5}$ and $5.0 \times 10^{-10}$ respectively. The overall dissociation constant of the acid will be

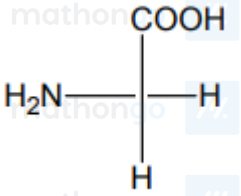
(1) $5.0 \times 10^{-5}$
(2) $5.0 \times 10^{15}$
(3) $5.0 \times 10^{-15}$
(4) $0.0 \times 10^{5}$

**Q60.** Which of the following molecules is expected to rotate the plane of plane polarized light?

(1) 


(2) 

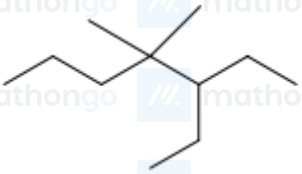

(3) 


(4) 


**Q61.** Which one of the following conformation of cyclohexane is chiral?

(1) Twist boat
(2) Rigid
(3) Chair
(4) Boat

**Q62.**



The IUPAC name of . . . . . is

(1) $1,1-$diethyl$-2,2-$dimethylpentane
(2) $4,4-$dimethyl$-5,5-$diethylpentane
(3) $5,5-$diethyl$-4,4-$diemthylpentane
(4) $3-$ethyl$-4,4-$dimethylheptane

**Q63.** The reaction of toluene with $Cl_2$ in presence of $FeCl_3$ gives predominantly

(1) benzoyl chloride
(2) benzyl chloride
(3) $o-$and $p-$chlorotoluene
(4) $m-$chlorotoluene

**Q64.** Presence of a nitro group in a benzene ring

(1) activates the ring towards electrophilic substitution
(2) renders the ring basic
(3) deactivates the ring towards nucleophilic substitution
(4) deactivates the ring towards electrophilic substitution

**Q65.** A mixture of ethyl alcohol and propyl alcohol has a vapour pressure of 290 mm at 300 K. The vapour pressure of propyl alcohol is 200 mm. If the mole fraction of ethyl alcohol is 0.6, its vapour pressure (in mm) at the same temperature will be

(1) 350
(2) 300
(3) 700
(4) 360

**Q66.** The cell, $\mathrm{Zn}\left|\mathrm{Zn}^{2+}(1\mathrm{M})\right\|\mathrm{Cu}^{2+}(1\mathrm{M})\left|\mathrm{Cu}\left(\mathrm{E}_{\text{cell}}^{0}=1.10\ \mathrm{V}\right)\right.$, was allowed to be completely discharged at 298 K. The relative concentration of $\mathrm{Zn}^{2+}$ to $\mathrm{Cu}^{2+}\left[\frac{\left[\mathrm{Zn}^{2+}\right]}{\left[\mathrm{Cu}^{2+}\right]}\right]$ is

(1) antilog $(24.08)$ (2) $37.3$

(3) $10^{37.3}$ (4) $9.65 \times 10^{4}$

**Q67.** The equivalent conductances of two strong electrolytes at infinite dilution in $\mathrm{H}_2\mathrm{O}$ (where ions move freely through a solution) at 25°C are given below: $\wedge^{\circ}\mathrm{CH}_3\mathrm{COONa}=91.0\ \mathrm{S\ cm^2}$ /equiv $\wedge_{\mathrm{HCl}}^{\circ}=426.2\ \mathrm{S\ cm^2}$ / equiv What additional information/quantity one needs to calculate $\wedge^{\circ}$ of an aqueous solution of acetic acid?

(1) $\wedge^{\circ}$ of NaCl (2) $\wedge^{\circ}$ of $\mathrm{CH}_3\mathrm{COOK}$

(3) The limiting equivalent conductance of $\mathrm{H}^{+}\left(\wedge_{\mathrm{H}^{+}}^{\circ}\right)$ (4) $\wedge^{\circ}$ of chloroacetic acid $\left(\mathrm{C}/\mathrm{CH}_2\mathrm{COOH}\right)$

**Q68.** The energies of activation for forward and reverse reactions for $A_2+B_2 \rightleftharpoons 2AB$ are 180 kJ $\mathrm{mol}^{-1}$ and 200 kJ $\mathrm{mol}^{-1}$ respectively. The presence of catalyst lowers the activation energy of both (forward and reverse) reactions by 100 kJ $\mathrm{mol}^{-1}$. The enthalpy change of the reaction $\left(\mathrm{A}_2+\mathrm{B}_2 \longrightarrow 2\mathrm{AB}\right)$ in the presence of catalyst will be (in kJ $\mathrm{mol}^{-1}$ )

(1) 300 (2) 120

(3) 280 (4) 20

**Q69.** Consider the reaction, $2\mathrm{A}+\mathrm{B} \rightarrow$ Products When concentration of B alone was doubled, the half-life did not change. When the concentration of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is

(1) L $\mathrm{mol}^{-1}$ $\mathrm{s}^{-1}$ (2) no unit

(3) mol $\mathrm{L}^{-1}$ $\mathrm{s}^{-1}$ (4) $\mathrm{s}^{-1}$

**Q70.** A radioactive element gets spilled over the floor of a room. Its half-life period is 30 days. If the initial activity is ten times the permissible value, after how many days will it be safe to enter the room?

(1) 1000 days (2) 300 days

(3) 10 days (4) 100 days

**Q71.** Identify the incorrect statement among the following

(1) Ozone reacts with $\mathrm{SO}_2$ to give $\mathrm{SO}_3$ (2) Silicon reacts with $\mathrm{NaOH}_{(\mathrm{aq})}$ in the presence of air to give $\mathrm{Na}_2\mathrm{SiO}_3$ and $\mathrm{H}_2\mathrm{O}$

(3) $\mathrm{Cl}_2$ reacts with excess of $\mathrm{NH}_3$ to give $\mathrm{N}_2$ and HCl (4) $\mathrm{Br}_2$ reacts with hot and strong NaOH solution to give $\mathrm{NaBr}, \mathrm{NaBrO}_4$ and $\mathrm{H}_2\mathrm{O}$

**Q72.** Identify the incorrect statement among the following

(1) d− Block elements show irregular and erratic chemical properties among themselves (2) La and Lu have partially filled $d$ orbitals and no other partially filled orbitals

(3) The chemistry of various lanthanoids is very similar (4) $4f$ and $5f$ orbitals are equally shielded

**Q73.** The actinoids exhibits more number of oxidation states in general than the lanthanoids. This is because

(1) the 5f orbitals are more buried than the 4f orbitals
(2) there is a similarity between 4f and 5f orbitals in their angular part of the wave function
(3) the actinoids are more reactive than the lanthanoids
(4) the $5f$ orbitals extend further from the nucleus than the 4f orbitals

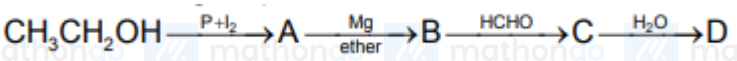
**Q74.** Which of the following nuclear reactions will generate an isotope?
(1) neutron particle emission
(2) positron emission
(3) $\alpha$-particle emission
(4) $\beta$-particle emission

**Q75.** Which one of the following has a square planar geometry?
(1) $[CoCl_4]^{2-}$
(2) $[FeCl_4]^{2-}$
(3) $[NiCl_4]^{2-}$
(4) $[PtCl_4]^{2-}$

**Q76.** Which of the following reactions will yield $2,2-$dibromopropane?
(1) $CH_3-C\equiv CH+2HBr\longrightarrow$
(2) $CH_3CH\equiv CHBr+HBr\longrightarrow$
(3) $CH\equiv CH+2HBr\longrightarrow$
(4) $CH_3-CH=CH_2+HBr\longrightarrow$

**Q77.** Which of the following is the correct order of decreasing $SN^2$ reactivity?
(1) $RCH_2X>R_3CX>R_2CHX$
(2) $RCH_2X>R_2CHX>R_3CX$
(3) $R_3CX>R_2CHX>RCH_2X$
(4) $R_2CHX>R_3CX>RCH_2X$ (X = a halogen )

**Q78.** In the following sequence of reactions,




the compound ' D ' is
(1) butanal
(2) $n-$butyl alcohol
(3) $n-$propyl alcohol
(4) propanal

**Q79.** The compound formed as a result of oxidation of ethyl benzene by $KMnO_4$ is
(1) benzophenone
(2) acetophenone
(3) benzoic acid
(4) benzyl alcohol

**Q80.** In the chemical reaction, $CH_3CH_2NH_2-CHCl_3+3KOH\longrightarrow(A)+(B)+3H_2O$, the compound $(A)$ and $(B)$ are respectively
(1) $C_2H_5CN$ and $3KCl$
(2) $CH_3CH_2CONH_2$ and $3KCl$
(3) $C_2H_5NC$ and $K_2CO_3$
(4) $C_2H_5NC$ and $3KCl$

**Q81.** Which one of the following is the strongest base in aqueous solution?
(1) Trimethylamine
(2) Aniline
(3) Dimethylamine
(4) Methylamine

**Q82.** The secondary structure of a protein refers to
(1) $\alpha$-helical backbone
(2) hydrophobic interactions
(3) sequence of $\alpha$-amino acids
(4) fixed configuration of the polypeptide backbone

**Q83.** If the difference between the roots of the equation $x^2+ax+1=0$ is less than $\sqrt{5}$, then the set of possible values of $a$ is

(1) $(-3, 3)$ (2) $(-3, \infty)$
(3) $(3, \infty)$ (4) $(-\infty, -3)$

**Q84.** If $|z+4| \leq 3$, then the maximum value of $|z+1|$ is
(1) 4 (2) 10
(3) 6 (4) 0

**Q85.** The set $S = \{1, 2, 3, \ldots, 12)$ is to be partitioned into three sets $A, B, C$ of equal size. Thus, $A \cup B \cup C = S, A \cap B = B \cap C = A \cap C = \phi$. The number of ways to partition $S$ is
(1) $\frac{12!}{3!(4!)^3}$ (2) $\frac{12!}{3!(3!)^4}$
(3) $\frac{12!}{(4!)^3}$ (4) $\frac{12!}{(3!)^4}$

**Q86.** In a geometric progression consisting of positive terms, each term equals the sum of the next two terms. Then the common ratio of this progression equals
(1) $\frac{1}{2}(1-\sqrt{5})$ (2) $\frac{1}{2}\sqrt{5}$
(3) $\sqrt{5}$ (4) $\frac{1}{2}(\sqrt{5}-1)$

**Q87.** If $p$ and $q$ are positive real numbers such that $p^2 + q^2 = 1$, then the maximum value of $(p+q)$ is
(1) 2 (2) $1/2$
(3) $\frac{1}{\sqrt{2}}$ (4) $\sqrt{2}$

**Q88.** The sum of the series $\frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!} - \ldots$ upto infinity is
(1) $e^{-2}$ (2) $e^{-1}$
(3) $\mathrm{e}^{-1/2}$ (4) $\mathrm{e}^{1/2}$

**Q89.** In the binomial expansion of $(a-b)^n, n \geq 5$, the sum of $5^{\text{th}}$ and $6^{\text{th}}$ terms is zero, then $\frac{a}{b}$ equals
(1) $\frac{5}{n-4}$ (2) $\frac{6}{n-5}$
(3) $\frac{n-5}{6}$ (4) $\frac{n-4}{5}$

**Q90.** The sum of the series ${}^{20}\mathrm{C}_0 - {}^{20}\mathrm{C}_1 + {}^{20}\mathrm{C}_2 - {}^{20}\mathrm{C}_3 + \ldots - \ldots + {}^{20}\mathrm{C}_{10}$ is
(1) $-{}^{20}\mathrm{C}_{10}$ (2) $\frac{1}{2}{}^{20}\mathrm{C}_{10}$
(3) 0 (4) ${}^{20}\mathrm{C}_{10}$

**Q91.** Let $A(h, k), B(1, 1)$ and $C(2, 1)$ be the vertices of a right angled triangle with $AC$ as its hypotenuse. If the area of the triangle is 1, then the set of values which ' k ' can take is given by
(1) $\{1, 3\}$ (2) $\{0, 2\}$
(3) $\{-1, 3\}$ (4) $\{-3, -2\}$

**Q92.** Let $P = (-1, 0), Q = (0, 0)$ and $R = (3, 3\sqrt{3})$ be three points. The equation of the bisector of the angle PQR
(1) $\sqrt{3}x + y = 0$ (2) $x + \frac{\sqrt{3}}{2}y = 0$
(3) $\frac{\sqrt{3}}{2}x + y = 0$ (4) $x + \sqrt{3}y = 0$

**Q93.** If one of the lines of $my^2 + \left(1 - m^2\right)xy - mx^2 = 0$ is a bisector of the angle between the lines $xy = 0$, then $m$ is

(1) $-1/2$ (2) $-2$
(3) $1$ (4) $2$

**Q94.** Consider a family of circles which are passing through the point $(-1, 1)$ and are tangent to $x-$ axis. If $(h, k)$ are the co-ordinates of the centre of the circles, then the set of values of $k$ is given by the interval
(1) $0 < \mathrm{k} < 1/2$ (2) $k \geq 1/2$
(3) $-1/2 \leq k \leq 1/2$ (4) $k \leq 1/2$

**Q95.** The equation of a tangent to the parabola $y^2 = 8x$ is $y = x + 2$. The point on this line from which the other tangent to the parabola is perpendicular to the given tangent is
(1) $(-1, 1)$ (2) $(0, 2)$
(3) $(2, 4)$ (4) $(-2, 0)$

**Q96.** For the hyperbola $\frac{x^2}{\cos^2\alpha} - \frac{y^2}{\sin^2\alpha} = 1$, which of the following remains constant when $\alpha$ varies?
(1) eccentricity (2) directrix
(3) abscissae of vertices (4) abscissae of foci

**Q97.** The function $f : R \sim \{0\} \to R$ given by $f(x) = \frac{1}{x} - \frac{2}{e^{2x}-1}$ can be made continuous at $x = 0$ by defining $f(0)$ as
(1) $2$ (2) $-1$
(3) $0$ (4) $1$

**Q98.** The average marks of boys in a class is $52$ and that of girls is $42$. The average marks of boys and girls combined is $50$. The percentage of boys in the class is
(1) $40$ (2) $20$
(3) $80$ (4) $60$

**Q99.** A tower stands at the centre of a circular park. $A$ and $B$ are two points on the boundary of the park such that $AB(= a)$ subtends an angle of $60^\circ$ at the foot of the tower, and the angle of elevation of the top of the tower from $A$ or $B$ is $30^\circ$. The height of the tower is
(1) $\frac{2a}{\sqrt{3}}$ (2) $2a\sqrt{3}$
(3) $\frac{a}{\sqrt{3}}$ (4) $a\sqrt{3}$

**Q100.** Let $A = \begin{bmatrix} 5 & 5\alpha & \alpha \\ 0 & \alpha & 5\alpha \\ 0 & 0 & 5 \end{bmatrix}$. If $\left|A^2\right| = 25$, then $|\alpha|$ equals
(1) $5^2$ (2) $1$
(3) $1/5$ (4) $5$

**Q101.** If $D = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+y \end{vmatrix}$ for $x \neq 0, y \neq 0$ then $D$ is
(1) divisible by neither $x$ nor $y$ (2) divisible by both $x$ and $y$
(3) divisible by $x$ but not $y$ (4) divisible by $y$ but not $x$

**Q102.** If $\sin^{-1}\left(\frac{x}{5}\right) + \operatorname{cosec}^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$ then a value of $x$ is

(1) 1 (2) 3
(3) 4 (4) 5

**Q103.** The largest interval lying in $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ for which the function $\left[f(x) = 4^{-x^2} + \cos^{-1}\left(\frac{x}{2} - 1\right) + \log(\cos x)\right]$ is defined, is
(1) $[0, \pi]$ (2) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
(3) $\left[-\frac{\pi}{4}, \frac{\pi}{2}\right)$ (4) $\left[0, \frac{\pi}{2}\right)$

**Q104.** Let $f : R \to R$ be a function defined by $f(x) = \text{Min}\{x + 1, |x| + 1\}$. Then which of the following is true?
(1) $f(x) \geq 1$ for all $x \in R$ (2) $f(x)$ is not differentiable at $x = 1$
(3) $f(x)$ is differentiable everywhere (4) $f(x)$ is not differentiable at $x = 0$

**Q105.** The normal to a curve at $P(x, y)$ meets the $x$-axis at $G$. If the distance of $G$ from the origin is twice the abscissa of $P$, then the curve is a
(1) ellipse (2) parabola
(3) circle (4) pair of straight lines

**Q106.** A value of $C$ for which the conclusion of Mean Value Theorem holds for the function $f(x) = \log_e x$ on the interval $[1, 3]$ is
(1) $2 \log_3 e$ (2) $\frac{1}{2}\log_e 3$
(3) $\log_3 e$ (4) $\log_e 3$

**Q107.** The function $f(x) = \tan^{-1}(\sin x + \cos x)$ is an increasing function in
(1) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ (2) $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$
(3) $\left(0, \frac{\pi}{2}\right)$ (4) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

**Q108.** $\int \frac{dx}{\cos x + \sqrt{3}\sin x}$ equals
(1) $\frac{1}{2}\log \tan\left(\frac{x}{2} + \frac{\pi}{12}\right) + c$ (2) $\frac{1}{2}\log \tan\left(\frac{x}{2} - \frac{\pi}{12}\right) + c$
(3) $\log \tan\left(\frac{x}{2} + \frac{\pi}{12}\right) + c$ (4) $\log \tan\left(\frac{x}{2} - \frac{\pi}{12}\right) + c$

**Q109.** Let $F(x) = f(x) + f\left(\frac{1}{x}\right)$, where $f(x) = \int_1^x \frac{\log t}{1+t} dt$. Then $F(e)$ equals
(1) $\frac{1}{2}$ (2) 0
(3) 1 (4) 2

**Q110.** The solution for $x$ of the equation $\int_{\sqrt{2}}^{x} \frac{dt}{t\sqrt{t^2-1}} = \frac{\pi}{2}$ is
(1) 2 (2) $\pi$
(3) $\frac{\sqrt{3}}{2}$ (4) None of these

**Q111.** The area enclosed between the curves $y^2 = x$ and $y = |x|$ is
(1) $2/3$ (2) 1
(3) $1/6$ (4) $1/3$

**Q112.** The differential equation of all circles passing through the origin and having their centres on the $x$-axis is
(1) $x^2 = y^2 + xy\frac{dy}{dx}$ (2) $x^2 = y^2 + 3xy\frac{dy}{dx}$
(3) $y^2 = x^2 + 2xy\frac{dy}{dx}$ (4) $y^2 = x^2 - 2xy\frac{dy}{dx}$

**Q113.** The resultant of two forces P N and 3 N is a force of 7 N. If the direction of 3 N force were reversed, the resultant would be $\sqrt{19}$ N. The value of P is

(1) 5 N (2) 6 N
(3) 3 N (4) 4 N

**Q114.** If $\hat{u}$ and $\hat{v}$ are unit vectors and $\theta$ is the acute angle between them, then $2\hat{u} \times 3\hat{v}$ is a unit vector for

(1) exactly two values of $\theta$ (2) more than two values of $\theta$
(3) no value of $\theta$ (4) exactly one value of $\theta$

**Q115.** Let $\bar{a} = \hat{i} + \hat{j} + \hat{k}, \bar{b} = \hat{i} - \hat{j} + 2\hat{k}$ and $\bar{c} = x\hat{i} + (x-2)\hat{j} - \hat{k}$. If the vector $\bar{c}$ lies in the plane of $\bar{a}$ and $\bar{b}$, then $x$ equals

(1) 0 (2) 1
(3) $-4$ (4) $-2$

**Q116.** Let $L$ be the line of intersection of the planes $2x + 3y + z = 1$ and $x + 3y + 2z = 2$. If $L$ makes an angles $\alpha$ with the positive $x$-axis, then $\cos\alpha$ equals

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

**Q117.** If a line makes an angle of $\frac{\pi}{4}$ with the positive directions of each of $x$-axis and $y$-axis, then the angle that the line makes with the positive direction of the $z-$axis is

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{3}$
(3) $\frac{\pi}{4}$ (4) $\frac{\pi}{2}$

**Q118.** If $(2, 3, 5)$ is one end of a diameter of the sphere $x^2 + y^2 + z^2 - 6x - 12y - 2z + 20 = 0$, then the coordinates of the other end of the diameter are

(1) $(4, 9, -3)$ (2) $(4, -3, 3)$
(3) $(4, 3, 5)$ (4) $(4, 3, -3)$

**Q119.** A pair of fair dice is thrown independently three times. The probability of getting a score of exactly 9 twice is

(1) $1/729$ (2) $8/9$
(3) $8/729$ (4) $8/243$

**Q120.** Two aeroplanes I and II bomb a target in succession. The probabilities of I and II scoring a hit correctly are 0.3 and 0.2, respectively. The second plane will bomb only if the first misses the target. The probability that the target is hit by the second plane is

(1) 0.06 (2) 0.14
(3) 0.2 (4) None of these

## ANSWER KEYS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1.** (2) | **2.** (4) | **3.** (3) | **4.** (3) | **5.** (1) | **6.** (3) | **7.** (1) | **8.** (3) |
| **9.** (1) | **10.** (3) | **11.** (3) | **12.** (2) | **13.** (1) | **14.** (1) | **15.** (1) | **16.** (4) |
| **17.** (4) | **18.** (1) | **19.** (4) | **20.** (2) | **21.** (4) | **22.** (4) | **23.** (1) | **24.** (4) |
| **25.** (4) | **26.** (3) | **27.** (3) | **28.** (3) | **29.** (1) | **30.** (1) | **31.** (1) | **32.** (4) |
| **33.** (2) | **34.** (2) | **35.** (4) | **36.** (4) | **37.** (3) | **38.** (2) | **39.** (2) | **40.** (2) |
| **41.** (4) | **42.** (4) | **43.** (3) | **44.** (2) | **45.** (3) | **46.** (2) | **47.** (2) | **48.** (1) |
| **49.** (3) | **50.** (3) | **51.** (4) | **52.** (4) | **53.** (3) | **54.** (1) | **55.** (4) | **56.** (3) |
| **57.** (2) | **58.** (4) | **59.** (3) | **60.** (1) | **61.** (1) | **62.** (4) | **63.** (3) | **64.** (4) |
| **65.** (1) | **66.** (3) | **67.** (1) | **68.** (4) | **69.** (1) | **70.** (4) | **71.** (4) | **72.** (4) |
| **73.** (4) | **74.** (1) | **75.** (4) | **76.** (1) | **77.** (2) | **78.** (3) | **79.** (3) | **80.** (4) |
| **81.** (3) | **82.** (1) | **83.** (1) | **84.** (3) | **85.** (3) | **86.** (4) | **87.** (4) | **88.** (2) |
| **89.** (4) | **90.** (2) | **91.** (3) | **92.** (1) | **93.** (3) | **94.** (2) | **95.** (4) | **96.** (4) |
| **97.** (4) | **98.** (3) | **99.** (3) | **100.** (3) | **101.** (2) | **102.** (2) | **103.** (4) | **104.** (3) |
| **105.** (1) | **106.** (1) | **107.** (2) | **108.** (1) | **109.** (1) | **110.** (4) | **111.** (3) | **112.** (3) |
| **113.** (1) | **114.** (4) | **115.** (4) | **116.** (1) | **117.** (4) | **118.** (1) | **119.** (4) | **120.** (4) |