**Q1.** A physical quantity $P$ is described by the relation $P = a^{\frac{1}{2}}\, b^2\, c^3 d^{-4}$. If the relative errors in the measurement of $a$, $b$, $c$ and $d$ respectively, are $2\%$, $1\%$, $3\%$ and $5\%$. Then the relative error in $P$ will be:

(1) $12\%$ (2) $8\%$

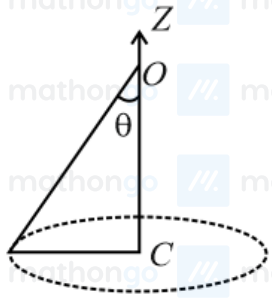
(3) $25\%$ (4) $32\%$

**Q2.** A car is standing $200\,\text{m}$ behind a bus, which is also at rest. The two start moving at the same instant but with different forward accelerations. The bus has acceleration $2\ \text{m s}^{-2}$ and the car has acceleration $4\,\text{m s}^{-2}$ . The car will catch up with the bus after time :

(1) $\sqrt{120}\ \text{s}$ (2) $15\ \text{s}$

(3) $\sqrt{110}\ \text{s}$ (4) $10\sqrt{2}\ \text{s}$

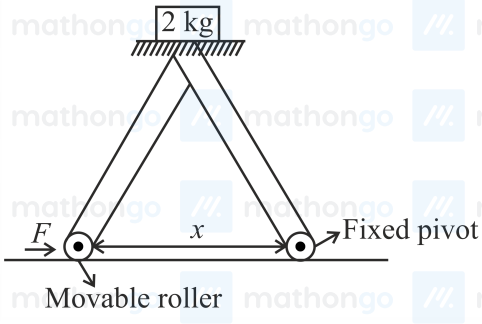
**Q3.** A conical pendulum of length $l$ makes an angle $\theta = 45^\circ$ with respect to $Z-$axis and moves in a circle in the $XY$ plane. The radius of the circle is $0.4\ \text{m}$ and its center is vertically below $O$. The speed of the pendulum, in its circular path, will be - $\left(\text{Take } g = 10\ \text{m s}^{-2}\right)$




(1) $0.2\ \text{m s}^{-1}$ (2) $0.4\ \text{m s}^{-1}$

(3) $2\ \text{m s}^{-1}$ (4) $4\ \text{m s}^{-1}$

**Q4.** The machine as shown has 2 rods of length $1\ \text{m}$ connected by a pivot at the top. The end of one rod is connected to the floor by a stationary pivot and the end of the other rod has roller that rolls along the floor in a slot. As the roller goes back and forth, a $2\ \text{kg}$ weight moves up and down. If the roller is moving towards right at a constant speed, the weight moves up with a :

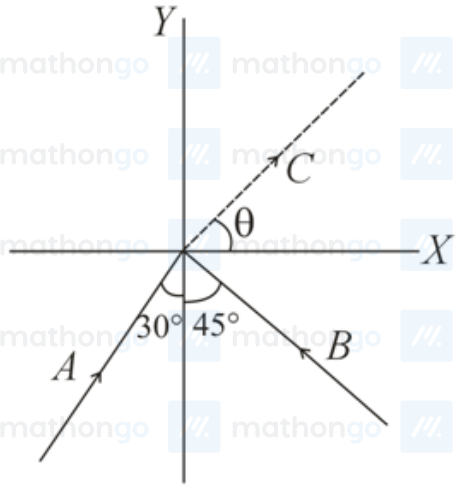



(1) Speed which is $\frac{3}{4}$th of that of the roller when the weight is $0.4\ \text{m}$ above the ground (2) Constant speed

(3) Decreasing speed (4) Increasing speed

**Q5.** Two particles $A$ and $B$ of equal mass $M$ are moving with the same speed $v$ as shown in figure. They collide completely inelastic and move as a single particle $C$. The angle $\theta$ that the path of $C$ makes with the $X$-axis is

given by-



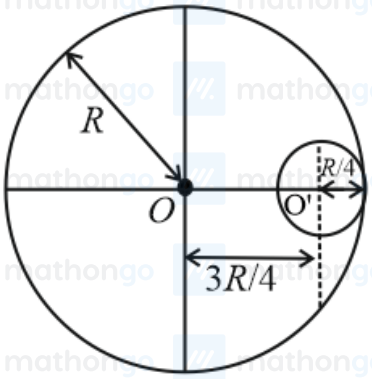

(1) $\tan\theta = \frac{\sqrt{3}-\sqrt{2}}{1-\sqrt{2}}$

(2) $\tan\theta = \frac{1-\sqrt{2}}{\sqrt{2}\left(1+\sqrt{3}\right)}$

(3) $\tan\theta = \frac{1-\sqrt{3}}{1+\sqrt{2}}$

(4) $\tan\theta = \frac{\sqrt{3}+\sqrt{2}}{1-\sqrt{2}}$

**Q6.** A circular hole of radius $\frac{R}{4}$ is made in a thin uniform disc having mass and radius $R$, as shown in figure. The moment of inertia of the remaining portion of the disc about an axis passing through the point $O$ and perpendicular to the plane of the disc is-




(1) $\frac{219MR^2}{256}$

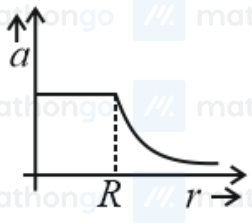
(2) $\frac{237MR^2}{512}$

(3) $\frac{197MR^2}{256}$

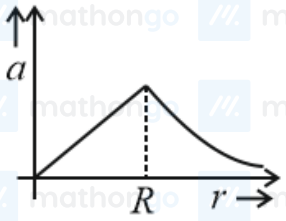
(4) $\frac{19MR^2}{512}$

**Q7.** The mass density of a spherical body is given by $\rho(r) = \frac{k}{r}$ for $r \leq R$ and $\rho(r) = 0$ for $r > R$, where $r$ is the distance from the center. The correct graph that describes qualitatively the acceleration, $a$ of a test particle as a function of $r$ is:

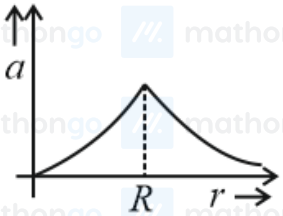
(1)



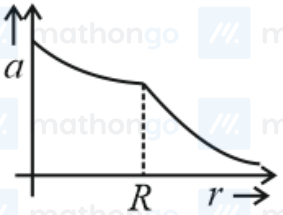

(2)




(3)




(4)



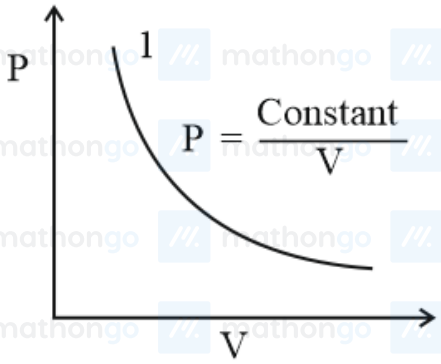

**Q8.** Two tubes of radii $r_1$ and $r_2$ and lengths $l_1$ and $l_2$, respectively, are connected in series and a liquid flows through each of them in stream line conditions. $P_1$ and $P_2$ are pressure differences across the two tubes. If $P_2$ is $4P_1$ and $l_2$ is $\frac{l_1}{4}$ then the radius $r_2$ will be equal to :

(1) $4r_1$
(2) $r_1$
(3) $2r_1$
(4) $\frac{r_1}{2}$

**Q9.** A steel rail of length 5 m and area of cross section 40 $cm^2$ is prevented from expanding along its length while the temperature rises by $10^{\circ}C$ . If coefficient of linear expansion and Young's modulus of steel are $1.2 \times 10^{-5}$ $K^{-1}$ and $2 \times 10^{11}$ N $m^{-2}$ respectively, the force developed in the rail is approximately:

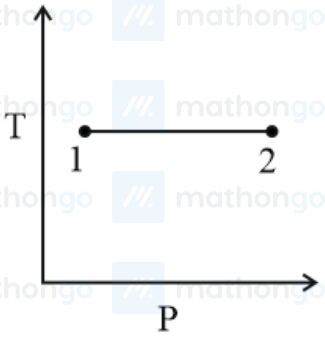
(1) $2 \times 10^7$ N
(2) $2 \times 10^9$ N
(3) $3 \times 10^{-5}$ N
(4) $1 \times 10^5$ N

**Q10.** For the $P - V$ diagram given for an ideal gas

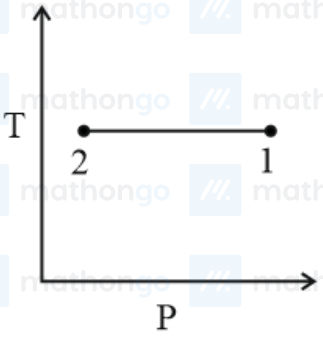



Out of the following which one correctly represents the $T - P$ diagram?

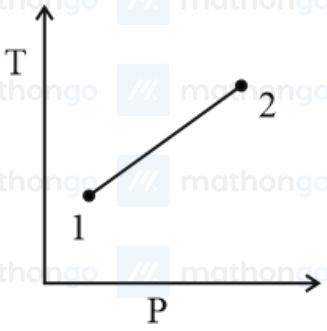
(1)



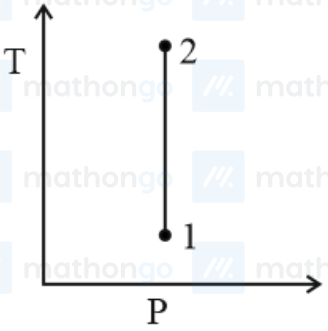

(2)




(3)




(4)




**Q11.** $N$ moles of diatomic gas in a cylinder is at a temperature $T$. Heat is supplied to the cylinder such that the temperature remains constant but $n$ moles of the diatomic gas get converted into monoatomic gas. The change in the total kinetic energy of the gas is

(1) 0
(2) $\frac{5}{2}nRT$
(3) $\frac{3}{2}nRT$
(4) $\frac{1}{2}nRT$

**Q12.** A block of mass $0.1$ kg is connected to an elastic spring of spring constant 640 N $m^{-1}$ and oscillates in a damping medium of damping constant $10^{-2}$ kg $s^{-1}$ . The system dissipates its energy gradually. The time taken for its mechanical energy of vibration to drop to half of its initial value, is closest to-

(1) 2 s
(2) 5 s
(3) 3 s
(4) 7 s

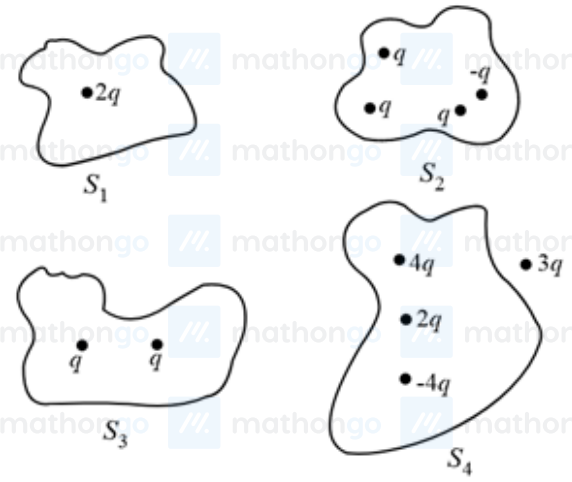
**Q13.** In an experiment to determine the period of a simple pendulum of length 1 m, it is attached to different spherical bobs of radii $r_1$ and $r_2$ . The two spherical bobs have uniform mass distribution. If the relative difference in the periods, is found to be $5 \times 10^{-4}$ s, the difference in radii, $|r_1 - r_2|$ is best-given by

(1) $0.01$ cm
(2) $0.05$ cm
(3) $0.5$ cm
(4) $1$ cm

**Q14.** A standing wave is formed by the superposition of two waves travelling in opposite directions. The transverse displacement is given by, $y(x,\ t) = 0.5\sin\left(\frac{5\pi}{4}x\right)\cos(200\pi t)$. What is the speed of the travelling wave moving in the positive $x$ direction? ($x$ and $t$ are in meter and second, respectively)

(1) 120 m $s^{-1}$
(2) 90 m $s^{-1}$
(3) 160 m $s^{-1}$
(4) 180 m $s^{-1}$

**Q15.** Four closed surfaces and corresponding charge distributions are shown below.




Let the respective electric fluxes through the surfaces be $\phi_1,\ \phi_2,\ \phi_3$ and $\phi_4$. Then:

(1) $\phi_1 > \phi_2 > \phi_3 > \phi_4$ (2) $\phi_1 < \phi_2 = \phi_3 > \phi_4$

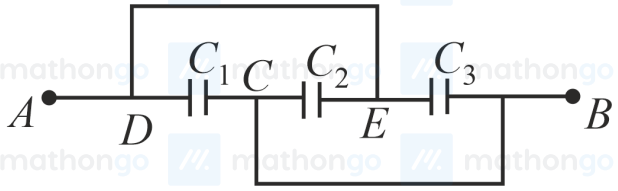
(3) $\phi_1 > \phi_3;\ \phi_2 < \phi_4$ (4) $\phi_1 = \phi_2 = \phi_3 = \phi_4$

**Q16.** A negative test charge is moving near a long straight wire carrying a current. The force acting on the test charge is parallel to the direction of the current. The motion of the charge is:

(1) Away from the wire (2) Towards the wire

(3) Parallel to the wire along the current (4) Parallel to the wire opposite to the current

**Q17.** A combination of parallel plate capacitors is maintained at a certain potential difference.



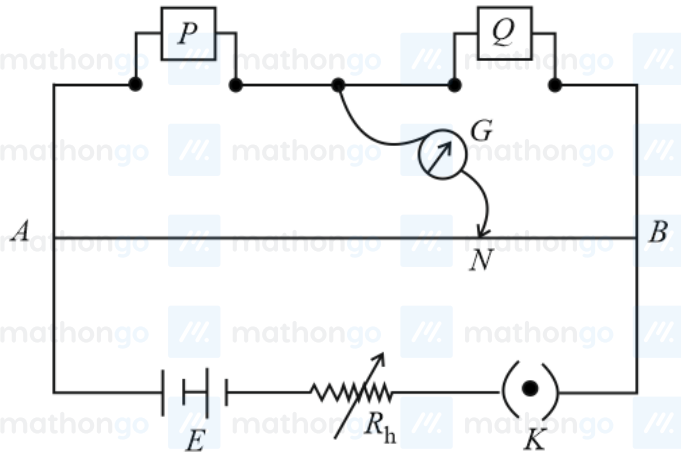

When a $3$ mm thick slab is introduced between all the plates, in order to maintain the same potential difference, the distance between the plates is increased by $2.4$ mm. Find the dielectric constant of the slab.

(1) 6 (2) 4

(3) 3 (4) 5

**Q18.** In a meter bridge experiment resistances are connected as shown in the figure. Initially resistance $P = 4\ \Omega$ and the neutral point $N$ is at $60$ cm from $A$. Now an unknown resistance $R$ is connected in series to $P$ and the new

position of the neutral point is at 80 cm from $A$. The value of unknown resistance $R$ is -

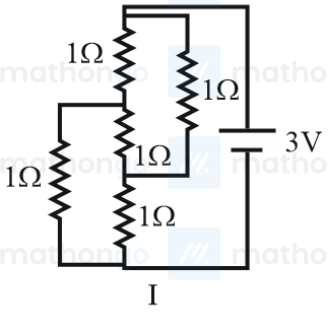



(1) $\frac{33}{5}\ \Omega$
(2) 6 $\Omega$
(3) $\frac{20}{3}\ \Omega$
(4) 7 $\Omega$

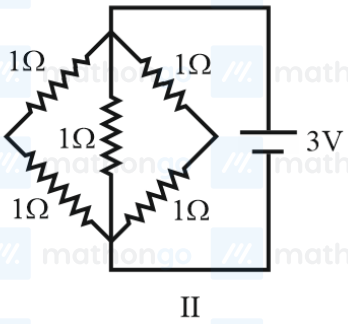
**Q19.** A uniform wire of length $l$ and radius $r$ has a resistance of 100 $\Omega$. It is recast into a wire of radius $\frac{r}{2}$. The resistance of new wire will be-

(1) 1600 $\Omega$
(2) 100 $\Omega$
(3) 200 $\Omega$
(4) 400 $\Omega$

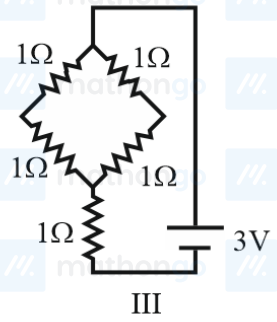
**Q20.** The figure shows three circuits $I$, $II$ and $III$ which are connected to a 3 V battery. If the powers dissipated by the configurations $I$, $II$ and $III$ are $P_1$, $P_2$ and $P_3$ respectively, then -



I



II

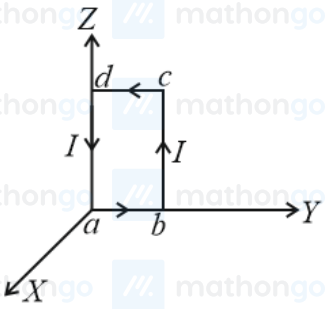


III

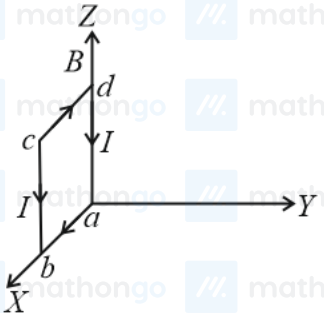
(1) $P_2 > P_1 > P_3$
(2) $P_1 > P_2 > P_3$
(3) $P_3 > P_2 > P_1$
(4) $P_1 > P_3 > P_2$

**Q21.** A uniform magnetic field $B$ of 0 .3 T is along the positive Z -direction. A rectangular loop ($abcd$) of sides 10 cm $\times$ 5 cm carries a current $I$ of 12 A. Out of the following different orientations which one corresponds to stable equilibrium?

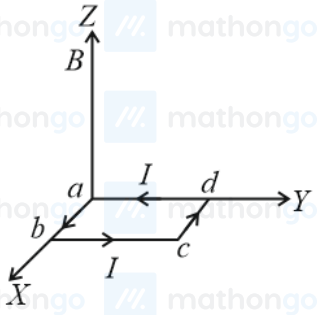
(1)



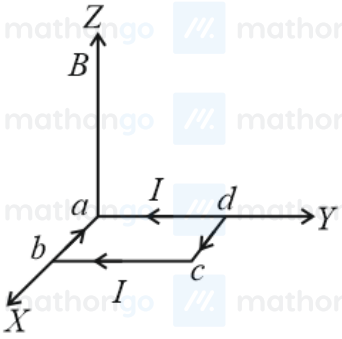

(2)




(3)




(4)




**Q22.** A sinusoidal voltage of peak value 283 V and angular frequency 320 $s^{-1}$ is applied to a series $LCR$ circuit. Given that $R = 5\ \Omega,\ L = 25$ mH and $C = 1000\ \mu$F. The total impedance and phase difference between the voltage across the source and the current will respectively be-

(1) 10 Ω and $\tan^{-1}\left(\frac{5}{3}\right)$
(2) 7 Ω and 45°
(3) 7 Ω and $\tan^{-1}\left(\frac{5}{3}\right)$
(4) 10 Ω and $\tan^{-1}\left(\frac{8}{3}\right)$

**Q23.** The electric field component of a monochromatic radiation is given by $\vec{E} = 2E_0 \cos kz \cos \omega t\ \hat{i}$, Its magnetic field $\vec{B}$ is then given by:

(1) $\frac{2E_0}{c} \sin kz \sin \omega t\ \hat{j}$
(2) $\frac{2E_0}{c} \cos kz \cos \omega t\ \hat{j}$
(3) $\frac{2E_0}{c} \sin kz \cos \omega t\ \hat{j}$
(4) $\frac{-2E_0}{c} \sin kz \sin \omega t\ \hat{j}$

**Q24.** In an experiment a convex lens of focal length 15 cm is placed coaxially on an optical bench in front of a convex mirror at a distance of 5 cm from it. It is found that an object and its image coincide, if the object is placed at a distance of 20 cm from the lens. The focal length of the convex mirror is-

(1) 20.0 cm
(2) 30.5 cm
(3) 25.0 cm
(4) 27.5 cm

**Q25.** A single slit of width 0.1 mm is illuminated by a parallel beam of light of wavelength 6000 Å and diffraction bands are observed on a screen 0.5 m from the slit. The distance of the third dark band from the central bright band is:

(1) 9 mm
(2) 3 mm
(3) 4.5 mm
(4) 1.5 mm

**Q26.** A laser light of wavelength 660 nm is used to weld Retina detachment. If a laser pulse of width 60 ms and power 0.5 kW is used, the approximate number of photons in the pulse are (Take Planck's Constant, $h = 6.62 \times 10^{-34}$ J s)

(1) $10^{22}$ (2) $10^{19}$
(3) $10^{20}$ (4) $10^{18}$

**Q27.** The acceleration of an electron in the first orbit of the hydrogen atom ($n = 1$) is :
(1) $\frac{h^2}{4\pi m^2 r^3}$ (2) $\frac{h^2}{\pi^2 m^2 r^3}$
(3) $\frac{h^2}{8\pi^2 m^2 r^3}$ (4) $\frac{h^2}{4\pi^2 m^2 r^3}$

**Q28.** Imagine that a reactor converts all the given mass into energy and that it operates at a power level of $10^9$ Watt . The mass of the fuel consumed per hour, in the reactor, will be:
(velocity of light, $c$ is $3 \times 10^8$ m s$^{-1}$)
(1) $6.6 \times 10^{-5}$ g (2) 0.96 g
(3) $4 \times 10^{-2}$ g (4) 0.8 g

**Q29.** The current gain of a common emitter amplifier is 69. If the emitter current is $7.0$ mA, collector current is :
(1) 69 mA (2) $0.69$ mA
(3) $6.9$ mA (4) $9.6$ mA

**Q30.** A signal is to be transmitted through a wave of wavelength $\lambda$, using a linear antenna. The length $l$ of the antenna and effective power radiated $P_{\text{eff}}$ will be given, respectively, as-
($K$ is a constant of proportionality)
(1) $\frac{\lambda}{8}$, $P_{\text{eff}} = K\left(\frac{l}{\lambda}\right)$ (2) $\frac{\lambda}{16}$, $P_{\text{eff}} = K\left(\frac{l}{\lambda}\right)^3$
(3) $\frac{\lambda}{5}$, $P_{\text{eff}} = K\left(\frac{l}{\lambda}\right)^{\frac{1}{2}}$ (4) $\lambda$, $P_{\text{eff}} = K\left(\frac{l}{\lambda}\right)^2$

**Q31.** What quantity (in mL) of a 45% acid solution of a mono-protic strong acid must be mixed with a 20% solution of the same acid to produce 800 mL of a 29.875% acid solution?
(1) 316 (2) 320
(3) 325 (4) 330

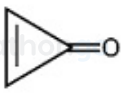
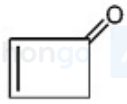
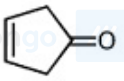
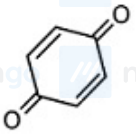
**Q32.** The electron in the hydrogen atom undergoes transition from higher orbitals to orbital of radius 211.6 pm. This transition is associated with
(1) Lyman series (2) Balmer series
(3) Brackett series (4) Paschen series

**Q33.** The electronic configuration with the highest ionization enthalpy is:
(1) [Ar] $3d^{10}$ $4s^2$ $4p^3$ (2) [Ne]$3s^2$ $3p^1$
(3) [Ne] $3s^2$ $3p^3$ (4) [Ne] $3s^2$ $3p^2$

**Q34.** The group having triangular planar structure is:
(1) $BF_3$, $NF_3$, $CO_3^{2-}$ (2) $CO_3^{2-}$, $NO_3^-$, $SO_3$
(3) $NH_3$, $SO_3$, $CO_3^{2-}$ (4) $NCl_3$, $BCl_3$, $SO_3$

**Q35.** The increasing order of the boiling points for the following compounds is:
(I)$C_2H_5OH$ (II)$C_2H_5Cl$ (III)$C_2H_5CH_3$ (IV) $C_2H_5OCH_3$
(1) (IV) < (III) < (I) < (II) (2) (III) < (II) < (I) < (IV)
(3) (III) < (IV) < (II) < (I) (4) (II) < (III) < (IV) < (I)

**Q36.** Among the following compounds, the compound which shows the highest dipole-moment is

(I)  (II)  (III)  (IV) 

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

**Q37.** At 300 K, the density of a certain gaseous molecule at 2 bar is double to that of dinitrogen $(N_2)$ at 4 bar. The molar mass of the gaseous molecule is
(1) 224 g $mol^{-1}$ (2) 112 g $mol^{-1}$
(3) 56 g $mol^{-1}$ (4) 28 g $mol^{-1}$

**Q38.** An ideal gas undergoes isothermal expansion at constant pressure. During the process:
(1) Enthalpy remains constant but entropy increases (2) Enthalpy decreases but entropy increases
(3) Enthalpy increases but entropy decreases (4) Both enthalpy and entropy remain constant

**Q39.** A gas undergoes change from state A to state B. In this process, the heat absorbed and work done by the gas is 5 J and 8 J, respectively. Now gas is brought back to A by another process during which 3 J of heat is evolved. In this reverse process of B to A.
(1) 6 J of the work will be done by the gas (2) 6 J of the work will be done by the surroundings on gas
(3) 10 J of the work will be done by the surroundings on gas (4) 10 J of the work will be done by the gas

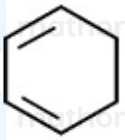
**Q40.** The following reaction occurs in the Blast Furnace where iron ore is reduced to iron metal:
$Fe_2O_3(s) + 3CO(g) \rightleftharpoons 2Fe\,(l) + 3CO_2(g)$
Using the Le Chatelier's principle, predict which one of the following will not disturb the equilibrium?
(1) Addition of $CO_2$ (2) Removal of $CO_2$
(3) Addition of $Fe_2O_3$ (4) Removal of CO

**Q41.** 50 mL of 0 .2 M ammonia solution is treated with 25 mL of 0. 2 M HCl. If $pK_b$ of ammonia solution is 4. 75, the pH of the mixture will be:
(1) 8. 25 (2) 9. 25
(3) 3. 75 (4) 4. 75

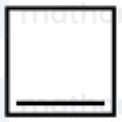
**Q42.** Which one of the following is an oxide?
(1) $SiO_2$ (2) $KO_2$
(3) $BaO_2$ (4) $CsO_2$

**Q43.** Which of the following compounds is most reactive to an aqueous solution of sodium carbonate?

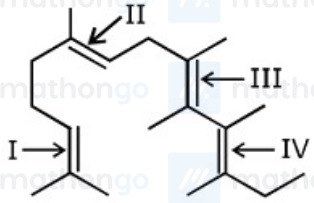
(1) 

(2) 

(3) 

(4) 

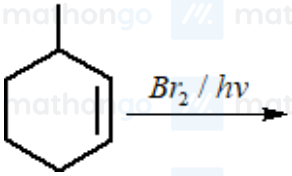
**Q44.** In the following structure, the double bonds are marked as I, II, III and IV.

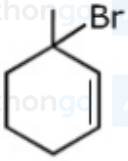


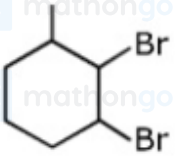

Geometrical isomerism is not possible at the site(s):

(1) I and III
(2) III
(3) I
(4) III and IV

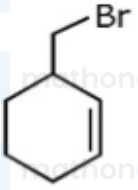
**Q45.** The major product of the following reaction is:




(1) 


(2) 


(3) 


(4) 


**Q46.** Which of the following is a set of greenhouse gases?

(1) $O_3,\ NO_2,\ S\,O_2,\ Cl_2$
(2) $CH_4,\ O_3,\ N_2,\ SO_2$
(3) $CO_2,\ CH_4,\ N_2O,\ O_3$
(4) $O_3,\ N_2,\ CO_2,\ NO_2$

**Q47.** A solution is prepared by mixing $8.5$ g of $CH_2\,Cl_2$ and $11.95$ g of $CHCl_3$ . If vapour pressure of $CH_2\,Cl_2$ and $CHCl_3$ at 298K are 415 and 200 mm Hg respectively, the mole fraction of $CHCl_3$ in vapour form is:
$\left(\text{Molar mass of Cl} = 35.5\ \text{g mol}^{-1}\right)$

(1) $0.162$
(2) $0.675$
(3) $0.325$
(4) $0.486$

**Q48.** Which of the following ions does not liberate hydrogen gas on reaction with dilute acids?

(1) $V^{2+}$ (2) $Ti^{2+}$

(3) $Mn^{2+}$ (4) $Cr^{2+}$

**Q49.** To find the standard potential of $M^{3+}/M$ electrode, the following cell is constituted:

$Pt/M/M^{3+}\left(0.001 \text{ mol } L^{-1}\right)/Ag^{+}\left(0.01 \text{ mol } L^{-1}\right)/Ag$

The emf of the cell is found to be $0.421$ volt at 298 K. The standard potential of half-reaction $M^{3+}+3e^{-}\rightarrow M$ at 298 K will be:

(Given: $E^{\ominus}_{Ag^{+}/Ag}$ at 298 K $=0.80$ volt)

(1) $0.38$ volt (2) $1.28$ volt

(3) $0.32$ volt (4) $0.66$ volt

**Q50.** The rate of a reaction quadruples when the temperature changes from $300$ to $310\,K$. The activation energy of this reaction is:

(Assume Activation energy and pre-exponential factor are independent of temperature;

$\ln(2)=0.693;\ R=8.314\ J\ mol^{-1}K^{-1}$)

(1) $53.6\ kJ\,mol^{-1}$ (2) $214.4\ kJ\,mol^{-1}$

(3) $107.2\ kJ\,mol^{-1}$ (4) $53.7\ kJ\,mol^{-1}$

**Q51.** Adsorption of gas on a surface follows Freundlich adsorption isotherm. The plot of $\log\frac{x}{m}$ versus $\log(P)$ gives a straight line with slope equal to $0.5$, then:

($\frac{x}{m}$ is the mass of the gas adsorbed per gram of adsorbent)

(1) adsorption is proportional to the square root of pressure. (2) adsorption is proportional to the square of pressure.

(3) adsorption is proportional to the pressure. (4) adsorption is independent of pressure.

**Q52.** The number of $P-OH$ bonds and the oxidation state of phosphorus atom in pyrophosphoric acid $(H_4P_2O_7)$, respectively are:

(1) Five and four. (2) Four and five.

(3) Five and five. (4) Four and four.

**Q53.** The correct sequence of decreasing number of $\pi$ -bonds in the structure of $H_2SO_3$, $H_2SO_4$ and $H_2S_2O_7$ is:

(1) $H_2S_2O_7>H_2SO_3>H_2SO_4$ (2) $H_2S_2O_7>H_2SO_4>H_2SO_3$

(3) $H_2SO_4>H_2S_2O_7>H_2SO_3$ (4) $H_2SO_3>H_2SO_4>H_2S_2O_7$

**Q54.** $XeF_6$ on partial hydrolysis with water, produces a compound X. The same compound X is formed when $XeF_6$ reacts with silica. The compound X is:

(1) $XeF_4$ (2) $XeF_2$

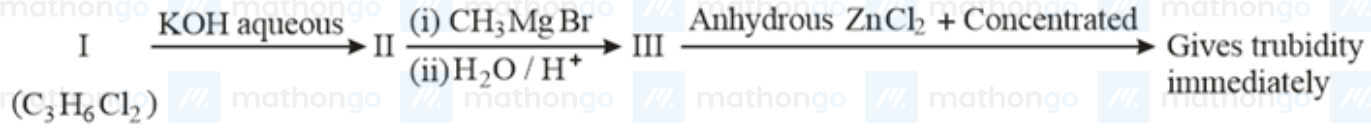
(3) $XeO_3$ (4) $XeOF_4$

**Q55.** $[Co_2(CO)_8]$ displays

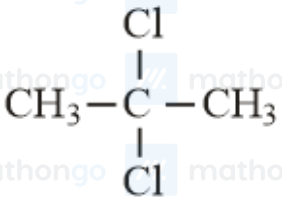
(1) no $Co-Co$ bonds, six terminal CO and two bridging CO. (2) no $Co-Co$ bonds, four terminal CO and four bridging CO.

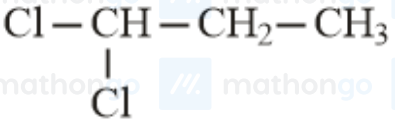
(3) one $Co-Co$ bonds, six terminal CO and two bridging CO. (4) one $Co-Co$ bonds, four terminal CO and four bridging CO.

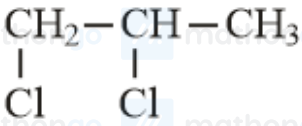
**Q56.** In the following reaction sequence:

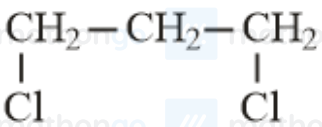



Compound I is

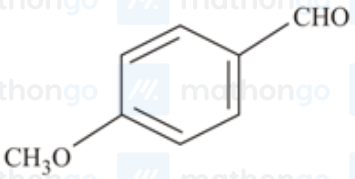
(1) 

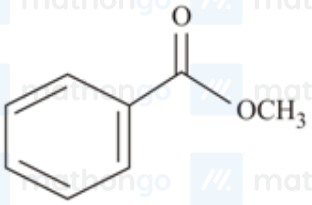
(2) 

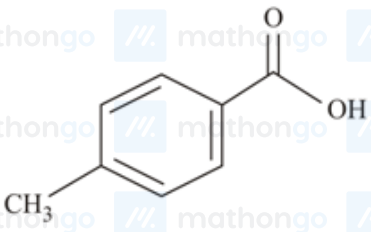
(3) 

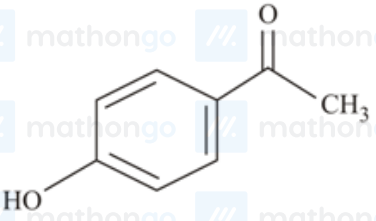
(4) 

**Q57.** A compound of molecular formula $C_8H_8O_2$ reacts with acetophenone to form a single cross-aldol product in the presence of base. The same compound on reaction with concentrated NaOH forms benzyl alcohol as one of the products. The structure of the compound is:

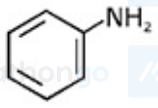
(1) 

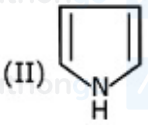
(2) 

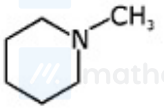
(3) 

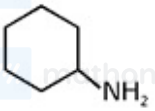
(4) 

**Q58.** Among the following compounds, the increasing order of their basic strength is:

(I) 

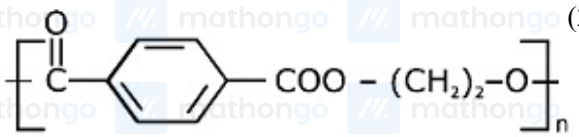
(II) 

(III) 

(IV) 

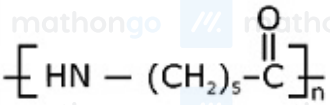
(1) (II) < (I) < (III) < (IV)
(2) (II) < (I) < (IV) < (III)
(3) (I) < (II) < (IV) < (III)
(4) (I) < (II) < (III) < (IV)

**Q59.** Which of the following is a biodegradable polymer?

(1) 

(2) 

(3) 

(4) 

**Q60.** The incorrect statement among the following is

(1) $\alpha-D-$glucose and $\beta-D-$ glucose are enantiomers.

(2) the penta acetate of glucose does not react with hydroxyl amine.

(3) $\alpha-D-$glucose and $\beta-D-$glucose are anomers.

(4) cellulose is a straight chain polysaccharide made up of only $\beta-D-$glucose units.

**Q61.** The sum of all the real values of $x$ Satisfying the equation $2^{(x-1)(x^2+5x-50)}=1$ is:

(1) 16

(2) $-5$

(3) $-4$

(4) 14

**Q62.** The equation $Im\left(\frac{iz-2}{z-i}\right)+1=0,\ z\in C,\ z\neq i$ represents a part of a circle having radius equal to :

(1) 1

(2) 2

(3) $\frac{3}{4}$

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

**Q63.** The number of ways in which 5 boys and 3 girls can be seated on a round table if a particular boy $B_1$ and a particular girl $G_1$ never sit adjacent to each other, is:

(1) 7!

(2) $5\times 6!$

(3) $6\times 6!$

(4) $5\times 7!$

**Q64.** If three positive numbers $a$, $b$ and $c$ are in A.P. such that $abc=8$, then the minimum possible value of $b$ is:

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

(2) 2

(3) $4^{\frac{1}{3}}$

(4) 4

**Q65.** Let $S_n=\frac{1}{1^3}+\frac{1+2}{1^3+2^3}+\frac{1+2+3}{1^3+2^3+3^3}+\ldots+\frac{1+2+\ldots,+n}{1^3+2^3+\ldots n^3}$ . If 100 $S_n=n$, then $n$ is equal to:

(1) 200

(2) 199

(3) 99

(4) 19

**Q66.** The coefficient of $x^{-5}$ in the binomial expansion of $\left(\frac{x+1}{x^{\frac{2}{3}}-x^{\frac{1}{3}}+1}-\frac{x-1}{x-x^{\frac{1}{2}}}\right)^{10}$ where $x\neq 0,1$ is

(1) $-1$

(2) 4

(3) 1

(4) $-4$

**Q67.** The lengths of two adjacent sides of a cyclic quadrilateral are 2 units and 5 units and the angle between them is $60^o$. If the area of the quadrilateral is $4\sqrt{3}$ sq. units, then the perimeter of the quadrilateral is

(1) 12.5 units

(2) 13 units

(3) 13.2 units

(4) 12 units

**Q68.** A square, of each side 2, lies above the $x$-axis and has one vertex at the origin. If one of the sides passing through the origin makes an angle $30^\circ$ with the positive direction of the $x$-axis , then the sum of the $x$-

coordinates of the vertices of the square is:

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

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

**Q69.** A line drawn through the point $P(4,7)$ cuts the circle $x^2+y^2=9$ at the points $A$ and $B$. Then $P_A \cdot P_B$ is equal to.

(1) 74 (2) 53

(3) 56 (4) 65

**Q70.** If $y=mx+c$ is the normal at a point on the parabola $y^2=8x$ whose focal distance is 8 units, then $|c|$ is equal to:

(1) $8\sqrt{3}$ (2) $10\sqrt{3}$

(3) $2\sqrt{3}$ (4) $16\sqrt{3}$

**Q71.** The eccentricity of an ellipse having centre at the origin, axes along the co-ordinate axes and passing through the points $(4,-1)$ and $(-2,2)$ is

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

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

**Q72.** The contrapositive of the statement 'If two numbers are not equal, then their squares are not equal', is

(1) If the squares of two numbers are equal, then the numbers are not equal

(2) If the squares of two numbers are not equal, then the numbers are equal

(3) If the squares of two numbers are not equal, then the numbers are not equal

(4) If the squares of two numbers are equal, then the numbers are equal

**Q73.** The sum of 100 observations and the sum of their squares are $400$ & $2475$, respectively. Later on, three observations $3,\ 4$ & $5$ were found to be incorrect. If the incorrect observations are omitted, then the variance of the remaining observations is

(1) $8.25$ (2) $8.50$

(3) $9.00$ (4) $8.00$

**Q74.** For two $3\times 3$ matrices $A$ and $B$, let $A+B=2B'$ and $3A+2B=I_3$, where $B'$ is the transpose of $B$ and $I_3$ is $3\times 3$ identity matrix. Then :

(1) $10A+5B=3I_3$ (2) $3A+6B=2I_3$

(3) $5A+10\text{B}=2I_3$ (4) $B+2A=I_3$

**Q75.** If $x=a,\ y=b,\ z=c$ is a solution of the system of linear equations

$x+8y+7z=0$

$9x+2y+3z=0$

$x+y+z=0$

Such that the point $(a,b,c)$ lies on the plane $x+2y+z=6$ , then $2a+b+c$ equals:

(1) 2 (2) $-1$

(3) 1 (4) 0

**Q76.** A value of $x$ satisfying the equation $\sin\left[\cot^{-1}(1+x)\right]=\cos\left[\tan^{-1}x\right]$, is:

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

**Q77.** The function $f : N \to I$ defined by $f(x) = x - 5\left[\frac{x}{5}\right]$, where $N$ is the set of natural numbers and $[x]$ denotes the greatest integer less than or equal to $x$, is:
(1) one-one but not onto (2) one-one and onto
(3) neither one-one nor onto (4) onto but not one-one

**Q78.** The value of $k$ which the function $f(x) = \begin{cases} \left(\frac{4}{5}\right)^{\frac{\tan 4x}{\tan 5x}}, & 0 < x < \frac{\pi}{2} \\ k + \frac{2}{5}, & x = \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$, is
(1) $\frac{2}{5}$ (2) $-\frac{2}{5}$
(3) $\frac{17}{20}$ (4) $\frac{3}{5}$

**Q79.** If $2x = y^{\frac{1}{5}} + y^{-\frac{1}{5}}$ and $\left(x^2 - 1\right)\frac{d^2y}{dx^2} + \lambda x\frac{dy}{dx} + ky = 0$, then $\lambda + k$ is equal to
(1) $26$ (2) $-24$
(3) $-23$ (4) $-26$

**Q80.** The function $f$ defined by $f(x) = x^3 - 3x^2 + 5x + 7$ is:
(1) Decreasing in $R$ (2) Increasing in $R$
(3) Increasing in $(0,\ \infty)$ and decreasing in $(-\infty,\ 0)$ (4) Decreasing in $(0,\ \infty)$ and increasing in $(-\infty,\ 0)$

**Q81.** If $f\left(\frac{3x-4}{3x+4}\right) = x + 2,\ x \neq -\frac{4}{3}$, and $\int f(x)dx = A\log|1 - x| + Bx + C$, then the ordered pair $(A,\ B)$ is equal to
(1) $\left(-\frac{8}{3}, -\frac{2}{3}\right)$ (2) $\left(-\frac{8}{3}, \frac{2}{3}\right)$
(3) $\left(\frac{8}{3}, \frac{2}{3}\right)$ (4) $\left(\frac{8}{3}, -\frac{2}{3}\right)$

**Q82.** If $\int_1^2 \frac{dx}{(x^2-2x+4)^{\frac{3}{2}}} = \frac{k}{k+5}$, then $k$ is equal to
(1) $4$ (2) $2$
(3) $3$ (4) $1$

**Q83.** If $\lim\limits_{n\to\infty}\left(\frac{1^a+2^a+\ldots+n^a}{(n+1)^{a-1}[(na+1)+(na+2)+\ldots+(na+n)]}\right) = \frac{1}{60}$ for some positive real number $a$, then $a$ is equal to
(1) $\frac{17}{2}$ (2) $\frac{15}{2}$
(3) $7$ (4) $8$

**Q84.** Let $f$ be a polynomial function such that $f(3x) = f'(x).\ f''(x)$, for all $x \in R$. Then :
(1) $f(2) + f'(2) = 28$ (2) $f''(2) - f'(2) = 0$
(3) $f(2) - f'(2) + f''(2) = 10$ (4) $f''(2) - f(2) = 4$

**Q85.** A tangent to the curve, $y = f(x)$ at $P(x,\ y)$ meets $x$-axis at $A$ and $y$-axis at $B$. If $AP : BP = 1 : 3$ and $f(1) = 1$, then the curve also passes through the point
(1) $\left(\frac{1}{3},\ 24\right)$ (2) $\left(\frac{1}{2},\ 4\right)$
(3) $\left(2, \frac{1}{8}\right)$ (4) $\left(3, \frac{1}{28}\right)$

**Q86.** If the vector $\overrightarrow{b} = 3\hat{j} + 4\hat{k}$ is written as the sum of a vector $\overrightarrow{b_1}$, parallel to $\overrightarrow{a} = \hat{i} + \hat{j}$ and a vector $\overrightarrow{b_2}$, perpendicular to $\overrightarrow{a}$, then $\overrightarrow{b_1} \times \overrightarrow{b_2}$ is equal to :

(1) $6\hat{i}-6\hat{j}+\frac{9}{2}\hat{k}$
(2) $-3\hat{i}+3\hat{j}-9\hat{k}$
(3) $-6\hat{i}+6\hat{j}-\frac{9}{2}\hat{k}$
(4) $3\hat{i}-3\hat{j}+9\hat{k}$

**Q87.** If the line, $\frac{x-3}{1}=\frac{y+2}{-1}=\frac{z+\lambda}{-2}$ lies in the plane, $2x-4y+3z=2$ , then the shortest distance between this line and the line, $\frac{x-1}{12}=\frac{y}{9}=\frac{z}{4}$ is
(1) 1
(2) 2
(3) 3
(4) 0

**Q88.** If a variable plane, at a distance of 3 units from the origin, intersects the coordinate axes at $A,\ B$ & $C$, then the locus of the centroid of $\Delta ABC$ is
(1) $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=1$
(2) $\frac{1}{x^2}+\frac{1}{y2}+\frac{1}{z^2}=3$
(3) $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=9$
(4) $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{9}$

**Q89.** From a group of 10 men and 5 women, four member committees are to be formed each of which must contain at least one women. Then the probability for these committees to have more women than men, is :
(1) $\frac{3}{11}$
(2) $\frac{2}{23}$
(3) $\frac{1}{11}$
(4) $\frac{21}{220}$

**Q90.** Let $E$ & $F$ be two independent events. The probability that $E$ & $F$ happen is $\frac{1}{12}$ and the probability that neither $E$ nor $F$ happens is $\frac{1}{2}$ , then a value of $\frac{P(E)}{P(F)}$ is:
(1) $\frac{4}{3}$
(2) $\frac{1}{3}$
(3) $\frac{3}{2}$
(4) $\frac{5}{12}$

## ANSWER KEYS

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