Question Paper

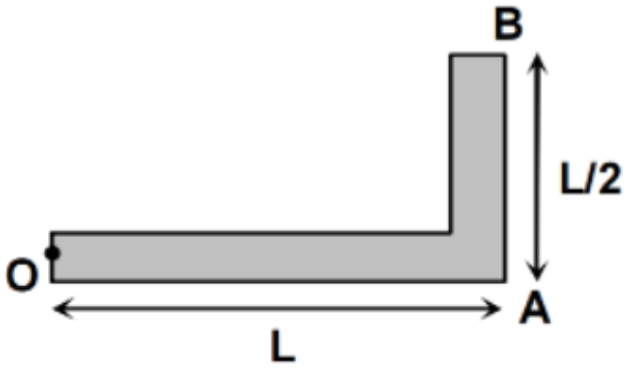
Physics Numerical (Maximum Marks: 28)

Question No. 1

Numerical Type

The answer has to be filled into the input box provided below.

A uniform rod OAB is bent in L shape to form right angle at A. Length of OA is L and that of AB is $\frac{L}{2}$ respectively as shown in figure. The rod is hinged at the end O and is free to rotate in a vertical plane about O. It is set free from rest, when larger section of it is in horizontal position. Maximum angular acceleration of rod is $\frac{\sqrt{65}}{K}\frac{g}{L}$. The value of K is

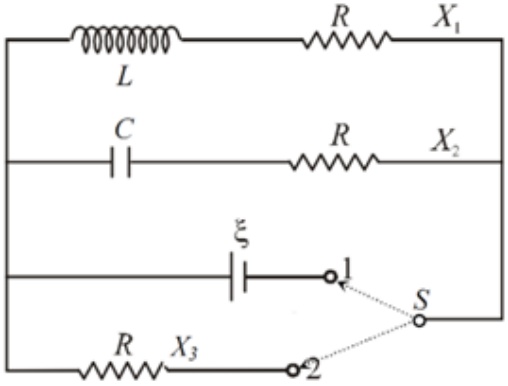


Question No. 2

Numerical Type

The answer has to be filled into the input box provided below.

Figure shows a circuit containing three resistor $X_1, X_2 \& X_3$ having resistance R each, an inductor, capacitor and an emf source having inductance 'L', capacitance C & emf ξ respectively (Given $R = \sqrt{\frac{L}{C}}$) . The switch is first connected to position-1. When charge on capacitor becomes half of it maximum possible value then switch S is connected to position-2. Current in resistance X_3 just after shifting the switch from position-1 to position-2, is
(given L = 5mH, C = 2μF, R = 10Ω, ξ = 5 V)



Question No. 3

Numerical Type

The answer has to be filled into the input box provided below.

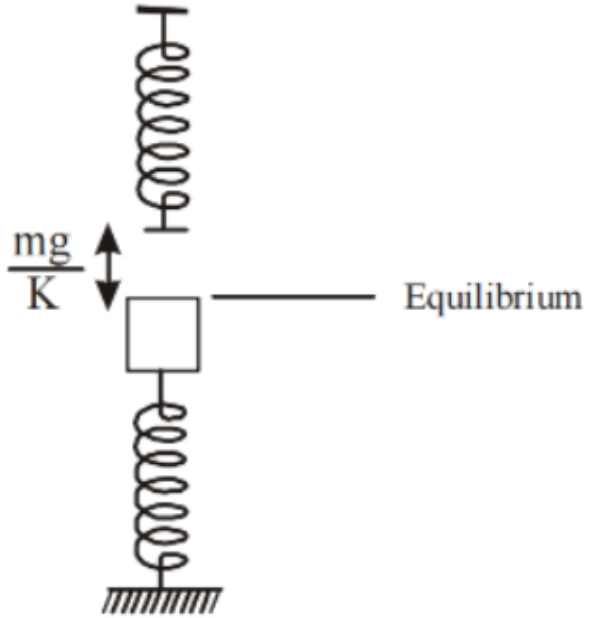
Two sound waves of frequencies 100 Hz and 102 Hz and having same amplitude 'A' are interfering. At a stationary detector, which can detect resultent amplitude greater than or equal to A. So, in a given time interval of 12 seconds, find the total duration in which detector is active.

Question No. 4

Numerical Type

The answer has to be filled into the input box provided below.

In the figure shown a block of mass m is attached in a light spring of spring constant K and an identical spring hangs from ceiling. Initially lower spring is compressed in a state with compression equal to $\frac{3mg}{K}$ from natural length of spring. When block is released it strikes upper spring and sticks to it. Amplitude of oscillation (in cm) is given mg = 10 N and K = $100\sqrt{7}$ N/m (roundoff answer to nearest integer)

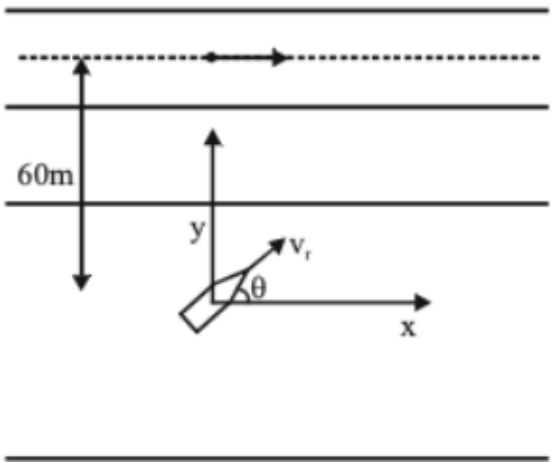


Question No. 5

Numerical Type

The answer has to be filled into the input box provided below.

Figure shows top view of a boat moving with velocity $\vec{v}_r = (8\hat{i} + 6\hat{j})$m/s relative to water. Water flows with velocity $\vec{v}_w = 2\hat{i}$ m/s relative to ground. A motor cyclist moves along a road running parallel to bank with velocity $\vec{v}_m = 20\hat{i}$ m/s . An apple thrown from boat is caught by motor cyclist in same horizontal plane after 4 sec of projection. If apple is thrown with velocity $v_x\hat{i} + v_y\hat{j} + v_z\hat{k}$ relative to boat fill value of $\frac{\left|\vec{v}_x\right| + \left|\vec{v}_y\right| + \left|\vec{v}_z\right|}{13}$.



Question No. 6

Numerical Type

The answer has to be filled into the input box provided below.

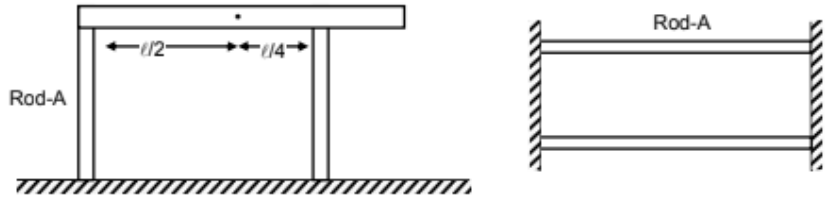
Consider the nuclear reaction $X^{200} \rightarrow A^{120} + B^{80}$. If the binding energy per nucleon for X, A and B are 7.4 MeV, 8.2 MeV and 8.1 MeV respectively, then the energy released in the reaction is $(19 \times n)$ MeV , the value of k is

Question No. 7

Numerical Type

The answer has to be filled into the input box provided below.

A uniform heavy plank of length L is resting on two rods of identical length and area of cross section, made up of different materials. It is observed that to keep the plank horizontal, one rod is to be at the end of the plank (say rod A) and another rod is to be at separation $\frac{L}{4}$ from centre of plank as shown in figure. Now the rods are kept between two rigid walls such that separation between the walls is equal to the natural length of the rod. Now temperature of both the rods is gradually increased in same manner, it is observed that thermal stress developed in rod A is always thrice the thermal stress developed in another rod. Ratio of coefficient of linear expansion of rod A to coefficient of linear expansion of another rod will be :



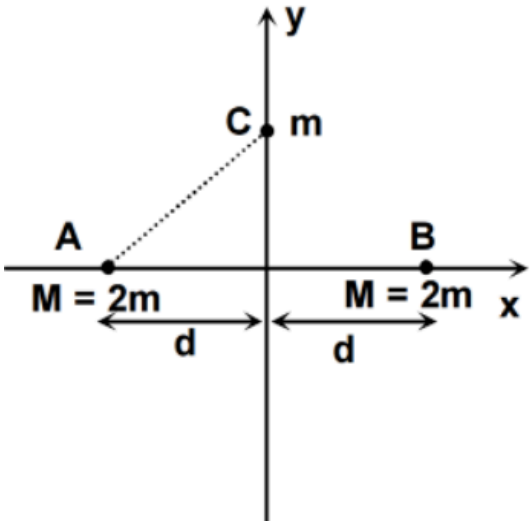
Physics Multiple Correct (Maximum Marks: 28)

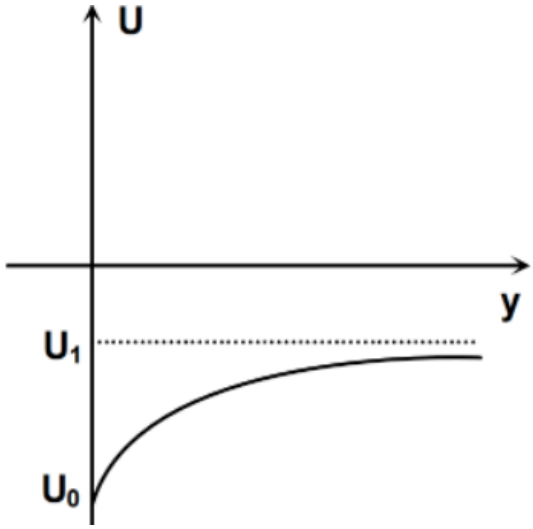
Question No. 1

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Two point masses, each of mass M are kept at rest at points A and B respectively. A third point m is released from infinity with a negligible speed, so that it can move along y-axis under the influence of mutual gravitational attraction on it due to point masses kept at A and B respectively as shown in the figure -1 . Figure -2 represents the potential energy of system (includes m, M at A and M at B) with position of m at y-axis. (Neglect any other forces other than gravity) (given $Gm^2/d = 12$ Joule $(m = 6\ kg)$. Choose the correct option(s)





A. Point mass m will perform periodic motion
B. $U_1 = -24$ Joule
C. Maximum speed of particle is 24 m/s
D. Maximum speed of particle is 4 m/s

Question No. 2

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

An element X is brought to an ionized hydrogenic ground state. It is then converted to a fully ionized form by absorption of monochromatic light of wavelength $1.42\ \text{nm}(1\ \text{nm} = 10^{-9}\ \text{m})$. (An ionized hydrogenic state is an ion with only one electron orbiting the nucleus.) Which of the following statement(s) is/are true ? (Take $R = 1.1 \times 10^7/\text{m}$)

A. The atomic number of the element is 6.

B. Its first Bohr orbit has a radius of $0.053\ \text{nm}$.

C. According to the Bohr model, the angular momentum of the hydrogenic ground state of the element X is about $10^{-34}\ \text{J s}$.

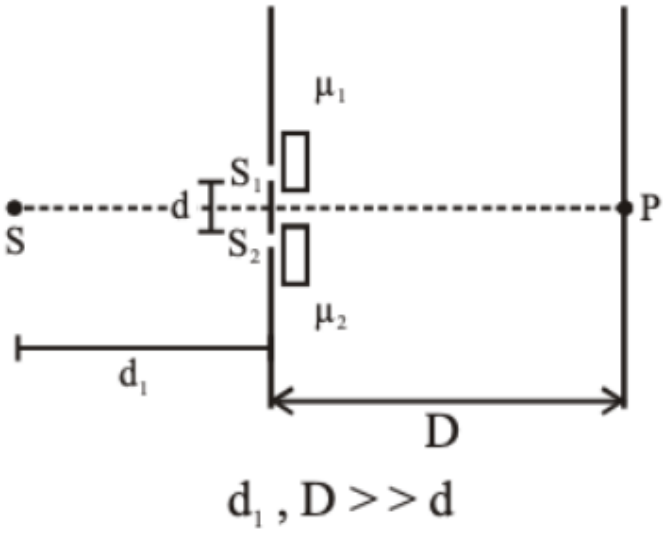
D. It is possible to reconvert it to the hydrogenic ground state by absorption of an electron followed by the emission of a photon of wavelength $1.42\ \text{nm}$.

Question No. 3

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

In young's experiment, the upper slit is covered by a thin glass plate of refractive index $\frac{4}{3}$ and of thickness 9λ, where λ is the wavelength of light used in the experiment. The lower slit is also covered by another glass plate of thickness 2λ & refractive index $\frac{3}{2}$, as shown in figure. If I_0 is the intensity at point P due to slits $S_1 \& S_2$ each, then :



$d_1, D >> d$

A. Intensity at point P is $4I_0$

B. Two fringes have been shifted in upward direction after insertion of both the glass plates together.

C. Optical path difference between the waves from $S_1 \& S_2$ at point P is 2λ.

D. If the source S is shifted upwards by a small distance d_2 then the fringe originally at P after inserting the plates, shifts downward by $D(\frac{d_2}{d_1})$.

Question No. 4

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

The pitch of a screw gauge is $1\ \text{mm}$ and its cap is divided into 100 divisions. There is no zero error in the screw gauge. When a wire is placed between its studs, the main scale reading is $3\ \text{mm}$ and 25^{th} division of circular scale coincides with the main scale. Find the diameter (in mm) of the wire.

A. $< 4\ \text{mm}$
B. $> 3\ \text{mm}$
C. $> 3.25\ \text{mm}$
D. $< 3.45\ \text{mm}$

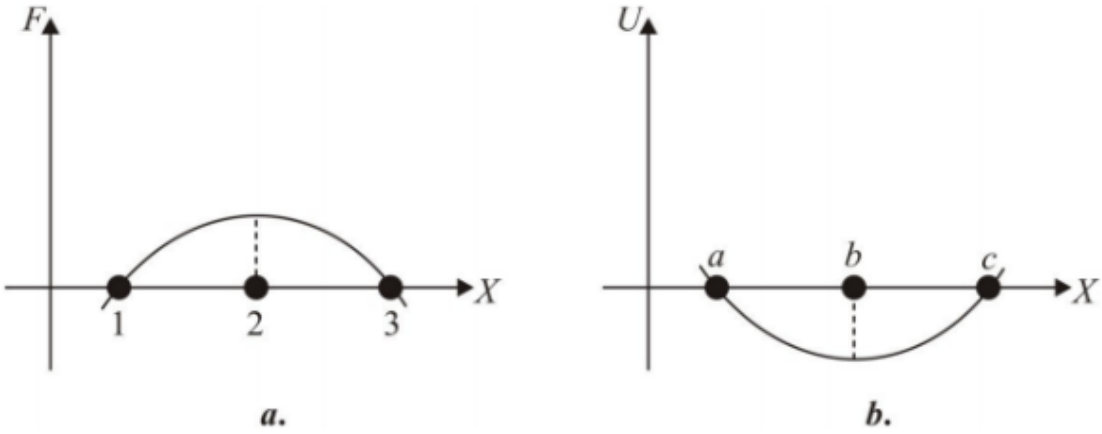
Question No. 5

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Referring the graph, which of the following is/are correct?

(Given : F = Force, X = displacement, U = potential energy)

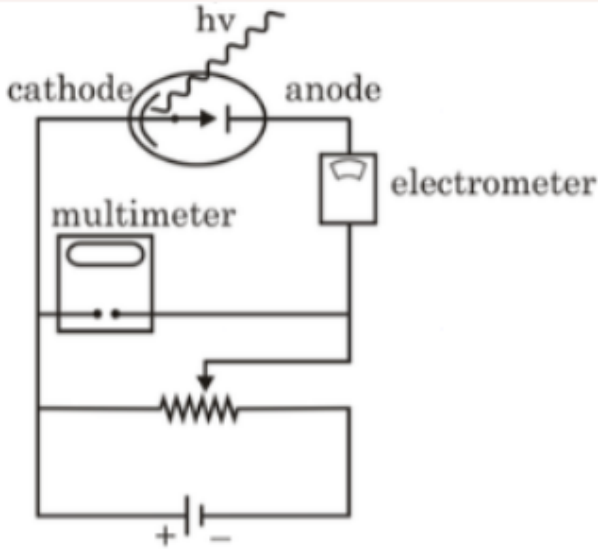


A. The particle has stable equilibrium at point 3 and *b*.
B. The particle is in neutral equilibrium at point *b* and 2 .
C. No power is delivered by the force on the particle at points 1,3 and *b*.
D. The particle has least kinetic energy at position 1 .

Question No. 6

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.



In the photoelectric effect experiment shown here, the electrometer measures current and multimeter the voltage across the photoelectric tube. The tube is illuminated by radiation from a mercury lamp. The mercury lamp radiates the wavelengths given in the chart below:

Mercury Spectrum (Hg)

Color	Frequency ($\times 10^{14}$hz)	Wavelength(nm)
Red	4.34	690.8
Yellow	5.19	578.0
Green	5.49	546.1
Blue	6.88	435.8
Violet	7.41	404.7
Ultraviolet	8.20	365.5

A. If the work function of cathode is 1.5eV, all the wavelengths in mercury spectrum can liberate photoelectrons from the cathode

B. If the resistance of the potentiometer is adjusted to be at the leftmost point, the reading in the electrometer will be maximum

C. If the resistance of the potentiometer is adjusted to be at the rightmost point, the reading in the electrometer will be maximum

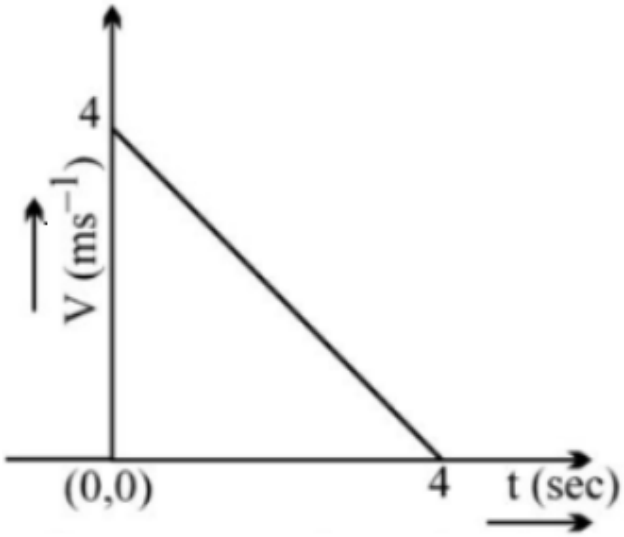
D. The multimeter reads 1 V, and electrometer just reads zero. The work function of the cathode is 2.39eV approx.

Question No. 7

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

The velocity time graph of the fig. shows the motion of a wooden block of mass 1 kg which is given an initial push t = 0 , along a horizontal table.



A. The coefficient of friction between the blocks and the table is 0.1
B. The coefficient of friction between the blocks and the table is 0.2
C. If the table was half of its present roughness, the time taken by the block to complete the journey is 4 sec.
D. If the table was half of its present roughness, the time taken by the block to complete the journey is 8 sec.

Physics Single Correct (Maximum Marks: 6)

Question No. 1

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

A stone with weight w is thrown vertically upward into air from ground level with initial speed v_0. If a constant force f due to air drag acts on the stone throughout its flight, the speed of stone just before impact with the ground is :-

A. $v_0\left(\frac{w-f}{w+f}\right)^{\frac{1}{2}}$
B. $v_0\left(\frac{w-f}{w+f}\right)^{\frac{3}{2}}$
C. $v_0\left(\frac{w-f}{w}\right)^{\frac{1}{2}}$
D. $v_0\left(\frac{w+f}{f}\right)^{-\frac{1}{2}}$

Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

A radioactive sample with half life = T emits α-particle. Its total activity is A_i at some time and A_f at a later time. The number of α-particles emitted by the sample between these two points of time is -

A. $A_i - A_f$

B. $\frac{T}{\ell n 2}(A_i - A_f)$

C. $\frac{\ell n 2}{T}[A_i - A_f]$

D. $\frac{T}{\ell n 2}\left[\frac{1}{A_i} - \frac{1}{A_f}\right]$

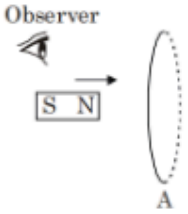
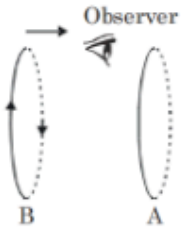
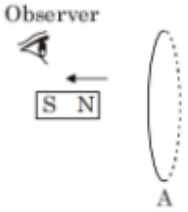
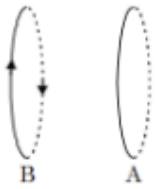
Physics Matrix Match Type (Maximum Marks: 6)

Question No. 1

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Match the following column

List-I	List-II (Direction of current in coil A at that instant)
(P) 	(1) Clockwise
(Q) 	(2) Anticlockwise
(R) 	(3) Zero
(S) 	(4) Cannot determine

A. $P \rightarrow 1; Q \rightarrow 2; R \rightarrow 3; S \rightarrow 4$

B. $P \rightarrow 2; Q \rightarrow 1; R \rightarrow 1; S \rightarrow 3$

C. $P \rightarrow 3; Q \rightarrow 4; R \rightarrow 2; S \rightarrow 1$

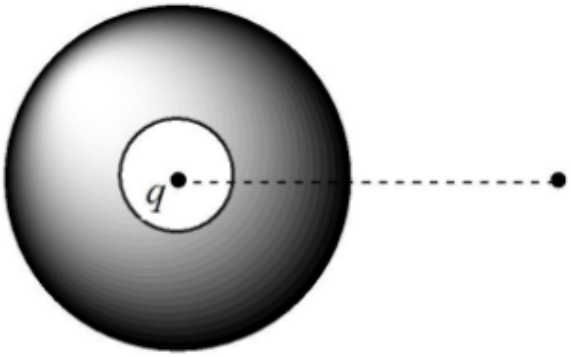
D. $P \rightarrow 4; Q \rightarrow 3; R \rightarrow 1; S \rightarrow 2$

Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

For the situation shown in Fig, match the entries of List-I with entries of List-II.



List-I	List-II
(P) If we displace the inside charge and outside charge is not present	(1) distribution of charge on inner surface of conductor is uniform.
(Q) If we displace the outside charge keeping the inside charge at center.	(2) distribution of charge on inner surface of conductor is non-uniform.
(R) If both the charges are displaced.	(3) distribution of charge on outer surface of conductor is uniform.
(S) If outside charge is not present and inside charge is at center,	(4) distribution of charge on outer surface of conductor is non-uniform.

A. $P \rightarrow 2,3; Q \rightarrow 1,4; R \rightarrow 2,4; S \rightarrow 1,3$
B. $P \rightarrow 1,4; Q \rightarrow 2; R \rightarrow 3; S \rightarrow 4$
C. $P \rightarrow 3; Q \rightarrow 1,3; R \rightarrow 2; S \rightarrow 3$
D. $P \rightarrow 3,4; Q \rightarrow 1; R \rightarrow 2,4; S \rightarrow 1$

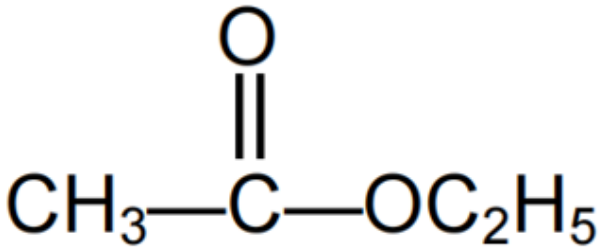
Chemistry Numerical (Maximum Marks: 28)

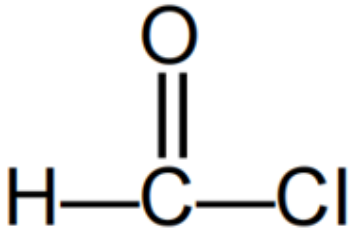
Question No. 1

Numerical Type

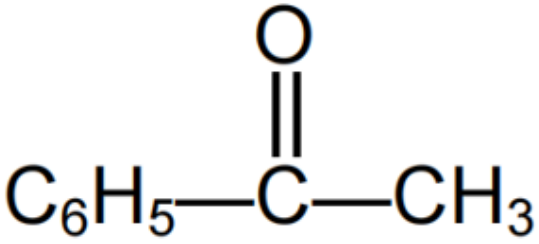
The answer has to be filled into the input box provided below.

How many compounds out of following use two or more moles of Grignard reagent to convert into alcohol after complete hydrolysis.

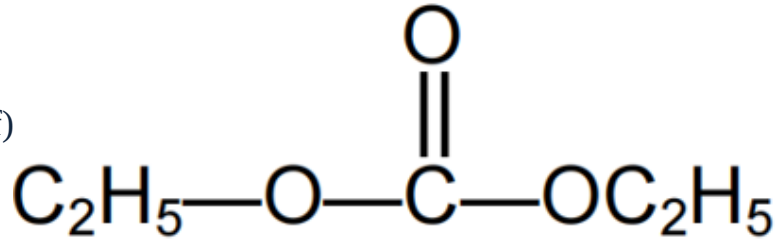
(a) 

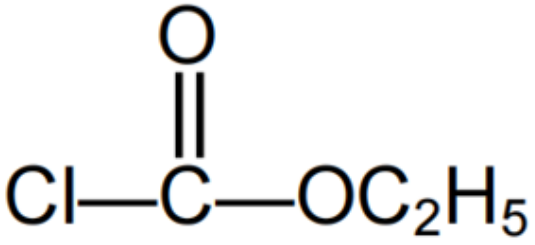
(b) 

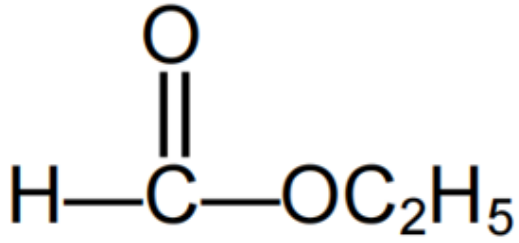
(c) CH_3CHO

(d) 

(e) $COCl_2$

(f) 

(g) 

(h) 

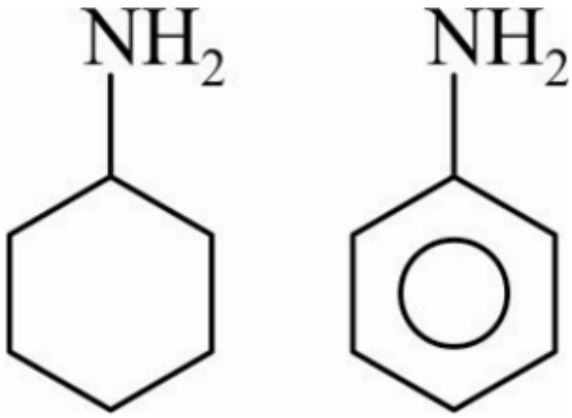
(i) C_6H_5COCl

Question No. 2

Numerical Type

The answer has to be filled into the input box provided below.

Find the number of tests by which given compounds can be distinguished.



(i) Isocyanide test

(ii) Hinsberg's test

(iii) Mustard oil test

(iv) Azo-dye test

(v) Lucas test

(vi) Victor Meyer's test

Question No. 3

Numerical Type

The answer has to be filled into the input box provided below.

A pentapeptide produces Alanine, Glycine, Valine, Leucine, Isoleucine on complete hydrolysis. If it contains $-COOH$ on alanine and $-NH_2$ on Glycine, then how many primary structures are possible for pentapeptide.

Question No. 4

Numerical Type

The answer has to be filled into the input box provided below.

How many of the following compounds will react with excess of KCN to form complex ions?

$AgNO_3,\ Pb(NO_3)_2, CuS, CuCN, CdCl_2, Fe(CN)_2, Fe(CN)_3, CoCl_2, NiCl_2, Ni(CN)_2$

Question No. 5

Numerical Type

The answer has to be filled into the input box provided below.

2 molal aqueous sugar solution is heated to $105.2^{\circ}C$. If the fraction of water (by mass) present in the solution that will vapourise out at this temperature is X. Then what is the value 10X ? (Take K_b of $H_2O = 0.52^{\circ}C$ kg mol^{-1})

Question No. 6

Numerical Type

The answer has to be filled into the input box provided below.

In a freundlich isotherm value of slope measured at low pressure is ' a ' and at high pressure ' b '. What is the value of $a + b$.

Question No. 7

Numerical Type

The answer has to be filled into the input box provided below.

Root mean square speed of an unknown gas at $727^{\circ}C$ is 10^5 cm/second . Calculate molar mass of unknown gas (in gram/mole) [Take R = $\frac{25}{3}$ J/ mole- K].

Chemistry Multiple Correct (Maximum Marks: 28)

Question No. 1

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

An ideal gas is expanded from $(P_1,\ V_1,\ T_1)$ to $(P_2,\ V_2,\ T_2)$ under different conditions. Correct statement(s) among the following is(are) :

A. The work done by the gas is maximum when it is expanded reversibly from $(P_1,\ V_1)$ to $(P_2,\ V_2)$

B. If the expansion is carried out in vacuum then $\Delta T = 0$ but $\Delta S > 0$

The final temperature of the gas is less when it is expanded reversibly from V_1 to V_2 under adiabatic conditions as compared to that when expanded irreversibly

C. from V_1 to V_2 against constant pressure P_1 under adiabatic conditions

The change in entropy of system is maximum when it is expanded reversibly from V_1 to V_2 under isothermal conditions as compared to that when expanded

D. reversibly from V_1 to V_2 under adiabatic conditions

Question No. 2

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

In the crystal field of the complex $[Fe(Cl)(CN)_4(O_2)]^{4-}$ the electronic configuration of metal is found to be $t_{2g}^6, \mathbf{e}_g^0$ then which of the following is true about this complex ion :

A. It is a paramagnetic complex

B. $O-O$ bond length will be less than found in O_2 molecule

C. Its IUPAC name will be chlorotetracyanosuperoxidoferrate (II) ion

D. It is a diamagnetic complex

Question No. 3

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Equivalent conductance of saturated solution of $BaSO_4$ is $400 ohm^{-1}\ cm^2 eqv^{-1}$ and specific conductance is $8 \times 10^{-5}\ ohm^{-1}\ cm^{-1}$. Hence Ksp of $BaSO_4$ is

A. $4 \times 10^{-8}\ m^2$

B. $1 \times 10^{-8}\ m^2$

C. $2 \times 10^{-4}\ m^2$

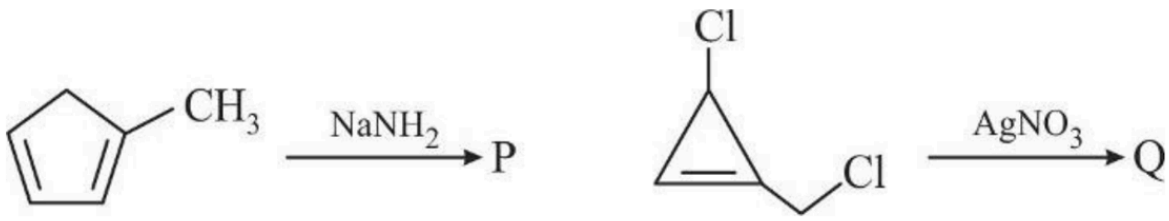
D. $1 \times 10^{-4}\ m^2$

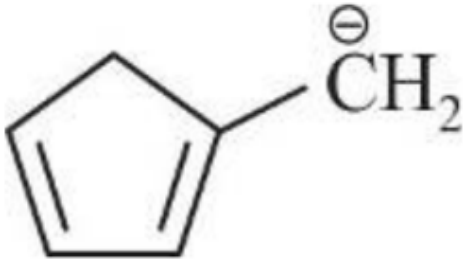
Question No. 4

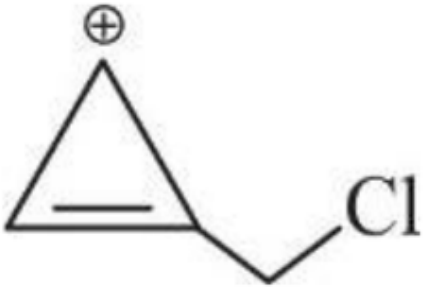
One or More Options Correct Type

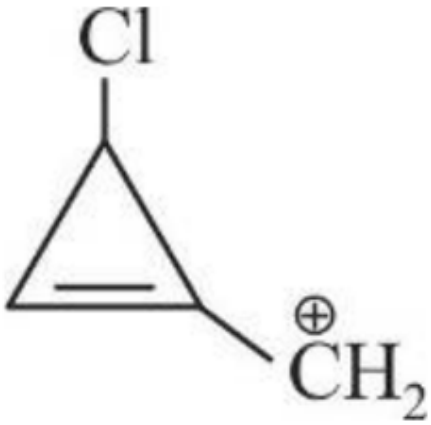
The question has multiple options out of which ONE or MORE is/are correct.

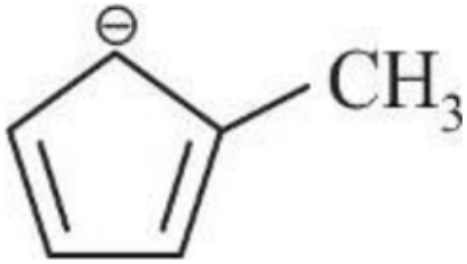
The products P and Q in the following reactions are:



A. 

B. 

C. 

D. 

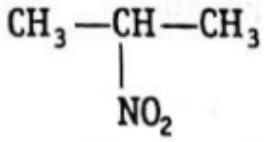
Question No. 5

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Nitration of propane with concentrated HNO_3 gives

A. CH_3NO_2
B. $CH_3CH_2CH_2NO_2$

C. 

D. $CH_3CH_2NO_2$

Question No. 6

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Which of the following disproportionate on heating with NaOH ?

A. P_4
B. S_8
C. Cl_2
D. Boron

Question No. 7

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Which of the following function of $\psi_{(r,\theta,\phi)}$ is correct for any unielectronic species.

A. $\psi_{(r,\theta,\hat{h})} = \frac{2}{3}\left(\frac{z}{3a_0}\right)^{3/2}(\sigma-1)(\sigma^2-8\sigma+12)e^{-\sigma/2}\cos\theta$

B. $\psi_{(r,\theta,\phi)} = \frac{1}{9\sqrt{6}}\left(\frac{z}{3a_0}\right)^{3/2}(4-\sigma)\sigma e^{-\sigma/2}\sin\theta\cos\phi$

C. $\Psi_{(r,\theta,\phi)} = \frac{1}{9\sqrt{3}}\left(\frac{z}{3a_0}\right)^{3/2}(6+6\sigma+\sigma^2)e^{-\sigma/2}$

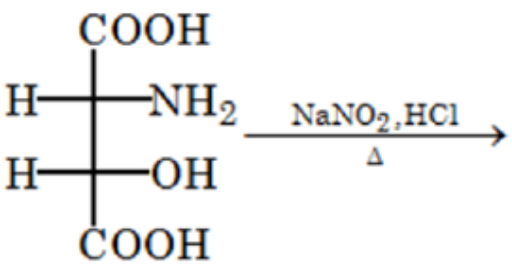
D. $\psi_{(r,\theta,\phi)} = \frac{1}{486}\left(\frac{6}{\pi a_0^3}\right)^{1/2}\sigma e^{-\sigma/3}(3\cos^2\theta-1)$

Chemistry Single Correct (Maximum Marks: 6)

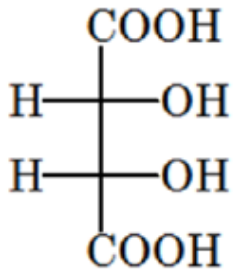
Question No. 1

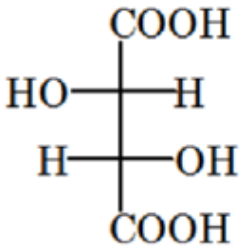
Only One Option Correct Type

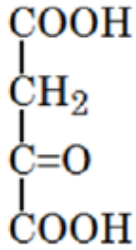
Each question has multiple options out of which ONLY ONE is correct.

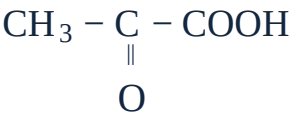


The major product in the given reaction is

A. 

B. 

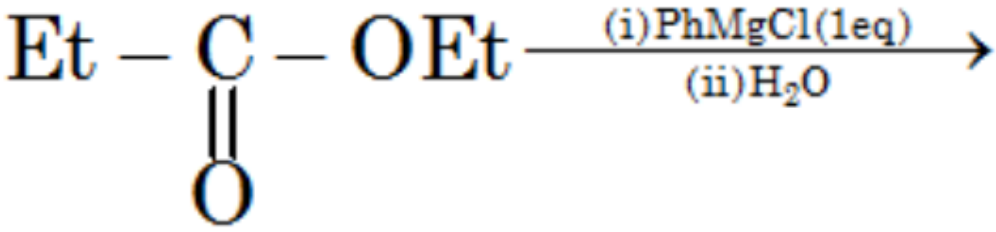
C. 

D. 

Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.



P_1(Ketone) + P_2 (Alcohol) True about product of above reaction

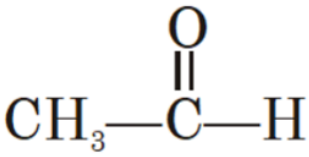
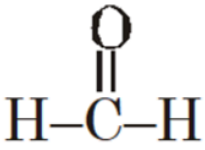
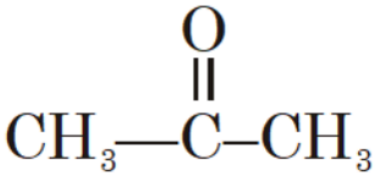
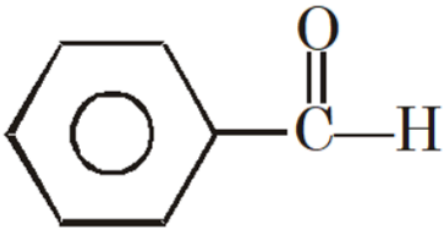
A. P_1 will give + ve iodoform test
B. Product P_2 will give CO_2 on heating
C. Product P_1 will give only one oxime with NH_2OH
D. Product P_1 will give alcohol with CH_3MgBr followed by hydrolysis.

Chemistry Matrix Match Type (Maximum Marks: 6)

Question No. 1

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

	List-I		List-II
(P)		(1)	Disproportionation reaction with OH^-
(Q)		(2)	Condensation reaction with OH^-
(R)		(3)	Silver mirror test
(S)		(4)	Haloform test

A. P → 1, 3; Q → 2, 4; R → 1, 3; S → 2, 3
B. P → 2, 3, 4; Q → 1, 3; R → 2, 4; S → 1, 3
C. P → 3, 4; Q → 2, 4; R → 1, 2, 3; S → 1, 2, 3
D. P → 1, 2, 3; Q → 2, 3; R → 3, 4; S → 2, 3

Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Match the thermodynamic processes given list I with the expressions given under list II.

\begin{array}{l|l} \hline \text{List-I} & \text{List-II} \\ \hline \text{(P) Melting of ice at } 273 \mathrm{~K} \text{ and } 1 \mathrm{~atm} & (1)~ q=0 \\ \hline \text{(Q) Expansion of } 1 \mathrm{~mol} \\ \text{ of an ideal gas into a vacuum under isolated conditions } & (2)~ \mathrm{w}=0 \\ \hline \text{(R) Mixing of equal volumes of two ideal gases at constant }\\ \text{ temperature and pressure in an isolated container } & (3)~ \Delta \mathrm{S}_{\mathrm{sys}} > 0 \\ \hline \text{(S) Reversible heating of } \mathrm{H}_2(\mathrm{~g}) \text{ (ideal) } \text{ at } 1 \mathrm{~atm} \text{ from } \mathrm{~K} \\ \text{ to } 600 \mathrm{~K},\text{ followed by reversible cooling to } 300 \mathrm{~K} \text{ at } 1 \mathrm{~atm} & (4)~ \Delta U=0 \\ \hline & (5)~ \Delta \mathrm{G}=0 \\ \hline \end{array}

A. $\mathrm{P} \rightarrow 4,5$
   $\mathrm{P} \rightarrow 1,4,5 \quad \mathrm{Q} \rightarrow 2,3,4 \quad
B. \mathrm{R} \rightarrow 3,4 \quad \mathrm{~S} \rightarrow 1,5$

C. $\mathrm{P} \rightarrow 1,2,3,4,5 \quad \mathrm{Q} \rightarrow 1,2,3 \quad \mathrm{R} \rightarrow 3,4 \quad \mathrm{~S} \rightarrow 1,5$

D. $\mathrm{P} \rightarrow 3,5 \quad \mathrm{Q} \rightarrow 1,2,3,4 \quad \mathrm{R} \rightarrow 1,2,3,4 \quad \mathrm{~S} \rightarrow 1,2,4,5$

Mathematics Numerical (Maximum Marks: 28)

Question No. 1

Numerical Type

The answer has to be filled into the input box provided below.

Let $P=\left[\begin{array}{ccc}-30 & 20 & 56 \\ 90 & 140 & 112 \\ 120 & 60 & 14\end{array}\right]$ and $A=\left[\begin{array}{ccc}2 & 7 & \omega^2 \\ -1 & -\omega & 1 \\ 0 & -\omega & -\omega+1\end{array}\right]$ where $\omega=\frac{-1+i \sqrt{3}}{2}$, and I_3 be the identity matrix of order 3. If the determinant of the matrix $\left(P^{-1} A P-I_3\right)^2$ is $\alpha \omega^2$, then the value of α is equal to _____

Question No. 2

Numerical Type

The answer has to be filled into the input box provided below.

$\text { If a polynomial function } f(x) \text { satisfies } f(f(f(x)))=8 x+21 \text {, then find } f(1)$

Question No. 3

Numerical Type

The answer has to be filled into the input box provided below.

If $\mathrm{S}_{\mathrm{n}}=1+\frac{1+3}{2 !}+\frac{1+3+3^2}{3 !}+\frac{1+3+3^2+3^3}{4 !} \ldots \ldots \ldots .$. upto n terms. And $\mathrm{L}=\left[\lim _{n \rightarrow \infty} S_n\right]$, (where [.] represent G.I.F), then find the number of roots of $\sin x=\frac{x}{L}$

Question No. 4

Numerical Type

The answer has to be filled into the input box provided below.

$\text { If } f(x)=\prod_{n=1}^{50}(x-n)^{n(51-n)} ; \text { then value of } \frac{f^{\prime}(51)}{f(51)} \text { is equal to }$

Question No. 5

Numerical Type

The answer has to be filled into the input box provided below.

On the axis of any given parabola $y^2=4 a x$, there exists a point K which has the property that for any chord $P Q$ of the parabola passing through $K, \frac{1}{P K^2}+\frac{1}{Q K^2}$ is constant given by $\frac{1}{\alpha \cdot a^\beta}$ then $\alpha+\beta$ equal to

Question No. 6

Numerical Type

The answer has to be filled into the input box provided below.

Two numbers are randomly selected and multiplied. Two events E_1 and E_2 are defined as E_1 :their product is divisible by $5 ; E_2$: Unit place digit in their product is 5 , then value of $\frac{P\left(E_1\right)}{2 P\left(E_2\right)} \frac{P\left(E_1 / E_2\right)}{P\left(E_2 / E_1\right)}$ is

Question No. 7

Numerical Type

The answer has to be filled into the input box provided below.

If $f(x)=a_0+a_1 x+a_2 x^2+a_3 x^3+\ldots \ldots a_n x^n+\ldots \ldots$ and $\frac{f(x)}{1-x}=b_0+b_1 x+b_2 x^2+\ldots . b_n x^n+\ldots$ If $a_0=1, b_1=3$ and $b_3=k$, then area bounded by the $y\left(1+x^2\right)=k, x$-axis, y-axis and $x=\sqrt{3}$ is A, then $[A]$ is (where [.] denotes greatest integer function) (Given $a_0, a_1, a_2, \ldots$ are in G.P.)

Mathematics Multiple Correct (Maximum Marks: 28)

Question No. 1

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Equation of the plane passing through the line of intersection of the two planes $\vec{r} \cdot \vec{n}_1=q_1$ and $\vec{r} \cdot \vec{n}_2=q_2$ and parallel to the line of intersection of $\vec{r} \cdot \vec{n}_3=q_3$ and $\vec{r} \cdot \vec{n}_4=q_4$ is

A. dependent on $\vec{n}_1 \cdot \vec{n}_3$
B. dependent on $\vec{n}_3 \cdot \vec{n}_4$
C. independent of q_1 and q_2
D. independent of q_3 and q_4

Question No. 2

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

If $(a+1)(b+1)(c+1)(d+1)=1,$ $(a+2)(b+2)(c+2)(d+2)=2,$ $(a+3)(b+3)(c+3)(d+3)=3$ $(a+4)(b+4)(c+4)(d+4)=4$. Then the value of $(a+5)(b+5)(c+5)(d+5)$ is

A. More than 25

B. less than 49
C. More than 36
D. An even number

Question No. 3

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

In a $\triangle A B C$ medians $A D$ and $B E$ are perpendicular to each other, then

A. $\frac{1}{2} < \frac{a}{b} < 2$
B. $\frac{1}{2} < \frac{c}{a} < 2$
C. $\frac{1}{2} < \frac{a}{c} < 2$
D. $\frac{1}{2} < \frac{b}{a} < 2$

Question No. 4

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

If ω is the imaginary cube root of unity such that $\left|\left(\sum_{r=1}^n\left(r \sum_{p=1}^r\left(\omega^{p-1}\right)\right)\right)-155 \omega\right|=\left(\sum_{r=1}^n\left(r \sum_{p=1}^r\left(\omega^{p-1}\right)\right)\right)-155 \omega$, then the value of n is equal to

A. 29
B. 30
C. 31
D. 32

Question No. 5

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

For the equation $2(\sin x-\cos 2 x)-\sin 2 x(1+2 \sin x)+2 \cos x=0, x \in[0,2 \pi]-$

A. the values of x satisfying the given equation forms an A.P.
B. the sum of all possible values of x satisfying the given equation is 4π
C. the sum of all possible values of x in $[0,2 \pi]$ satisfying the given equation is $\frac{9 \pi}{2}$
D. there are five solutions of the equation in $[0,2 \pi]$

Question No. 6

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

For the equation $\cos ^{-1}\left(\frac{x^2-1}{x^2+1}\right)+\sin ^{-1}\left(\frac{2 x}{x^2+1}\right)+\tan ^{-1}\left(\frac{2 x}{x^2-1}\right)=\frac{2 \pi}{3}$, which of the following is/are correct.

A. The number of solution is 2
B. It has at least one irrational solution
C. The sum of solution is positive
D. The sum of solution is negative

Question No. 7

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

For the ellipse $2 x^2-2 x y+4 y^2-(3+\sqrt{2})=0$, the inclination of major axis of it with x-axis is

A. $\frac{\pi}{12}$
B. $\frac{\pi}{8}$
C. $\frac{3 \pi}{8}$
D. $\frac{5 \pi}{8}$

Mathematics Single Correct (Maximum Marks: 6)

Question No. 1

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

$\vec{r}$ is a position vector of a variable point in $x y$ plane such that $\vec{r} \cdot(10 j-8 i-\vec{r})=40$ and $p_1=\max \left\{|\vec{r}+2 \hat{i}-3 \hat{j}|^2\right\}, p_2=\min \left\{|\vec{r}+2 \hat{i}-3 \hat{j}|^2\right\}$. A tangent drawn to the curve $y=\frac{8}{x^2}$ at point A with abscissa 2, the drawn line cuts the x axis at point B then

A. $p_2=9+4 \sqrt{2}$
B. $p_1+p_2=17$
C. $\overrightarrow{\mathrm{AB}} \cdot \overrightarrow{\mathrm{OB}}=3$
D. $\overrightarrow{\mathrm{AB}} \cdot \overrightarrow{\mathrm{OB}}=1$

Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

If $1 + 3 + 5 + \ldots + p + 1 + 3 + 5 + \ldots + q = 1 + 3 + 5 + \ldots + r$, where each set of parentheses contains the sum of consecutive odd integers as shown, the smallest possible value of $p + q + r$, (where $p > 6$) is

A. 12
B. 21
C. 45
D. 54

Mathematics Matrix Match Type (Maximum Marks: 6)

Question No. 1

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

$\text { Column-I with Column-II (where [.] denotes GIF and }\{.\} \text { denotes fractional part function) }$

List-I		List-II	
(P)	For $f(x) = \begin{cases} \frac{\lvert x-2\rvert}{x-2}[\log_e x], & 1 \leqslant x \leqslant 3-\{2\} \\ \{x^2\}, & 3 < x \leqslant \frac{7}{2} \end{cases}$ number of points of discontinuity is	(1)	0
(Q)	For $f(x) = \begin{cases} \left(\sqrt{2} + \sin\frac{1}{x}\right) e^{\frac{-1}{\lvert x\rvert}} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$ number of points of extremum is	(2)	5
(R)	number of points where $f(x) = \max\{\lvert 3 - x^2\rvert, 3 - x^3\}$ is not differentiable	(3)	2
(S)	$2\lim_{x\to 0} x^2\left(1 + 2 + 3 + \ldots + \left[\frac{1}{\lvert x\rvert}\right]\right) =,$ where [x] represents GIF	(4)	1

A. $\mathrm{P} \rightarrow 2 ; \mathrm{Q} \rightarrow 1 ; \mathrm{R} \rightarrow 4 ; \mathrm{S} \rightarrow 3$

B. $\mathrm{P} \rightarrow 2 ; \mathrm{Q} \rightarrow 3 ; \mathrm{R} \rightarrow 1 ; \mathrm{S} \rightarrow 4$

C. $\mathrm{P} \rightarrow 2 ; \mathrm{Q} \rightarrow 4 ; \mathrm{R} \rightarrow 3 ; \mathrm{S} \rightarrow 4$

D. $\mathrm{P} \rightarrow 1 ; \mathrm{Q} \rightarrow 2 ; \mathrm{R} \rightarrow 3 ; \mathrm{S} \rightarrow 4$

Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Match the following:

List-I		List-II	
(P)	If $\sin^{-1}\lvert\cos x\rvert - \cos^{-1}\lvert\sin x\rvert = a$ has atleast one solution, then the exhaustive set in which 'a' can lie	(1)	$\{0\}$
(Q)	If equation $\sin^{-1}\sqrt{x} + \cos^{-1}\sqrt{x^2 - 1} + \tan^{-1}\tan y = a$ has atleast one solution, then the exhaustive set in which 'a' can lie	(2)	$\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$
(R)	If $\sqrt{\lvert\sin^{-1}\lvert\sin x\rvert\rvert} + \sqrt{\lvert\tan^{-1}\lvert\tan x\rvert\rvert} = 2\sqrt{a}$ has atleast one solution, then the exhaustive set in which 'a' can lie	(3)	$\left[0, \frac{\pi}{2}\right)$
(S)	$\sin^{-1}(x^2 + y^2) + \tan^{-1}\sqrt{4y^2 - 1} + \sec^{-1}x = a$, then the exhaustive set in which 'a' can lie	(4)	ϕ

A. $\mathrm{P} \rightarrow 1 ; \mathrm{Q} \rightarrow 2 ; \mathrm{R} \rightarrow 4 ; \mathrm{S} \rightarrow 3$

B. $\mathrm{P} \rightarrow 1$; $\rightarrow 4 ; \mathrm{R} \rightarrow 3 ; \mathrm{S} \rightarrow 2$

C. $\mathrm{P} \rightarrow 2 ; \mathrm{Q} \rightarrow 1 ; \mathrm{R} \rightarrow 4 ; \mathrm{S} \rightarrow 3$

D. $\mathrm{P} \rightarrow 1 ; \mathrm{Q} \rightarrow 2 ; \mathrm{R} \rightarrow 3 ; \mathrm{S} \rightarrow 4$