Vidyamandir Classes
Gurukul for IITJEE Preparation

Mock Advanced Test-6 Paper-1

TIME : 3 hrs	M.M. : 186

Read the following Instructions very carefully before you proceed.

1. The question paper consists of 3 Subjects (Subject I : Chemistry, Subject II : Physics,Subject III : Mathematics). Each Subject has 2 sections (Section I and Section II)

2. **Section I** contains 2 types of questions **[Type 1 & Type 2]**
Type 1 contains **5 Single Correct Answer Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE is correct**.

- *Marking scheme* [3 *Marks for Correct answer* & ***–1 NEGATIVE MARKING*** *for wrong answer*]

Type 2 contains **8 Multiple Correct Answer Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE CHOICES may be correct**.

- *Marking scheme* [4 *Marks for All Correct answers*, +1 *for Partially correct answer and* ***–2 NEGATIVE MARKING*** *for wrong answer*]

3. **Section II** contains **5 Single Integer Value Type Questions**. The answer to each of the questions is a single-digit integer, ranging from 0 to 9 (both inclusive).

- *Marking scheme* [3 *Marks for Correct answer* & ***NO NEGATIVE MARKING*** *for wrong answer*]

4. For answering a question, an ANSWER SHEET (OMR SHEET) is provided separately. Please fill your **Test Code, Roll No.** and **Group** properly in the space given in the ANSWER SHEET.

5. **No one will be permitted to leave the test room before the end of the test, i.e. 01.00 PM**

SUBJECT - I (CHEMISTRY)	62 MARKS

SECTION - I [TYPE-1]

SINGLE CORRECT ANSWER TYPE

This section contains 5 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

Q.1 Which of the following is/are correct for $3dxy$ orbital ?

I. It has two radical nodes **II.** Its shape is different from $3dx^2 - y^2$

III. Its energy is different from $3dz^2$

IV. It has two nodal planes passing through the origin and bisecting the xy plane containing z-axis.

(A) I **(B)** IV **(C)** II, III **(D)** II, IV

Q.2 The molar entropy of 1, 2-difluorobenzene in crystalline state at 0 K is :

(A) $R\ell n 6$ **(B)** 0 **(C)** $R\ell n 2$ **(D)** $3R\ell n 2$

Q.3 For which of the following element(s) the electronic configuration do not follow the diagonal rule?

I. Chromium (atomic number = 24) **II.** Nickel (atomic number = 28)

III. Molybdenum (atomic number = 42) **IV.** Palladium (atomic number = 46)

(A) Only I **(B)** I, II, IV **(C)** II, IV **(D)** I, III, IV

Q.4 Among $O_2PtF_6, \left[V(CO)_6\right], \left[AuBr_4\right]^-, \left[NiCl_4\right]^{2-}, AlO_2^-, KO_2$ the total number of diamagnetic compound is :

(A) 3 **(B)** 2 **(C)** 5 **(D)** 6

Q.5 Elastomers are flexible polymers that can be stretched but return to their original state when stretching force is released. This property is observed due to :

(A) Weak intermolecular forces **(B)** Hydrogen Bonding

(C) Cross linking **(D)** Covalent Bonding

SPACE FOR ROUGH WORK

SECTION - I [TYPE-2]

MULTIPLE CORRECT ANSWERS TYPE

This section contains 8 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:

Q.6 The observed rate of a chemical reaction is substantially lower than the according to collision frequency. Which of the following statement is/are true to account for this fact ?

(A) The reactants do not have the required energy

(B) The partners do not collide in the proper orientation

(C) Collision complex exist for a very short time

(D) Collision frequency over estimates the number of effective collisions

Q.7 At 25°C, 200 cm^3 of 1.0 mol dm^{-3} nitric acid is added to 5.0 g of magnesium powder. If the experiment is repeated using the same mass of magnesium powder, which conditions will result in the same initial reaction rate ?

	Volume of HNO_3 (cm^3)	Concentration of HNO_3 (mol dm^{-3})	Temperature (°C)
(A)	200	2.0	25
(B)	200	1.0	50
(C)	100	2.0	25
(D)	100	1.0	25

Q.8 $CuSO_4$ on reaction with excess of KCN forms :

(A) $K_3[Cu(CN)_4]$ **(B)** $(CN)_2$ **(C)** K_2SO_4 **(D)** $K_2[Cu(CN)_4]$

SPACE FOR ROUGH WORK

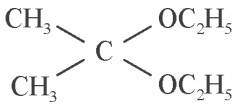
Q.9 sp^2 hybridisation is involved in the molecules of (of central atom) :

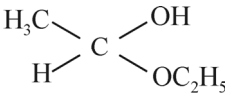
(A) SO_2 **(B)** SO_3 **(C)** CO_2 **(D)** CO

Q.10 Pair (s) in which one of the ion is possible to be separated from other by using dilute HCl and H_2S is :

(A) Bi^{3+}, Al^{3+} **(B)** Al^{3+}, Cr^{3+} **(C)** Mn^{2+}, Cu^{2+} **(D)** Pb^{2+}, Hg^{2+}

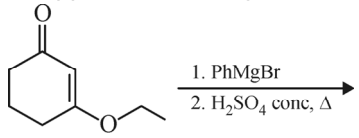
Q.11 Which of the following compounds give negative test with Tollen's reagent ?

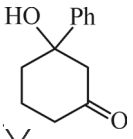
(A) $Ph-\underset{\underset{O}{\|}}{C}-H$ **(B)** 

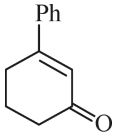
(C)  **(D)** $CH_3-\underset{\underset{O}{\|}}{C}-CH_2-OH$

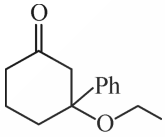
SPACE FOR ROUGH WORK

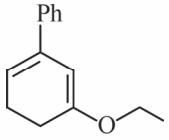
Q.12 The product(s) of the following reaction sequence is/are :

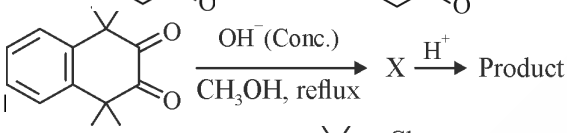


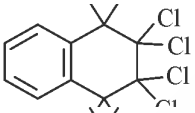
(A) 

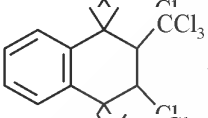
(B) 

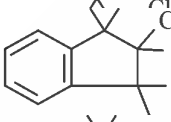
(C) 

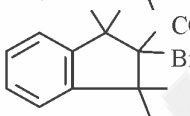
(D) 

Q.13 

(A) Reaction of  with aq. KOH followed by acidification

(B) Reaction of  with aq. KOH followed by acidification

(C) Reaction of  with aq. KOH followed by acidification

(D) Reaction of  with aq. KOH followed by acidification

SPACE FOR ROUGH WORK

SECTION - II

SINGLE INTEGER VALUE CORRECT TYPE

This section contains 5 single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

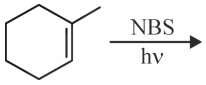
Q.1 A useful application of oxalic acid is for the removal of rust. Calculate the amount of rust (Fe_2O_3) in gm that can be dissolved in 5.00×10^2 mL of 0.350 M oxalic acid solution.
[Molecular mass of $Fe_2O_3 = 160$]

Q.2 The ratio of excluded volume and actual volume of a real gas is equal to …….

Q.3. 2.07 gm of Pb was burned in air to give red lead (Pb_3O_4). Red lead was then titrated with 12 ml of $0.01M$ acidified $KMnO_4$ solution. Calculate the % of Pb converted to PbO during burning.
[Atomic mass of $Pb = 207$]

Q.4 The number of geometrical isomers possible for trigonal-bipyramidal complex having formula $[MLA_2X]$ is ……..
[M is central atom, A and X are unidentate ligand, L represent a bidentate ligand $H_2NCH_2CH_2NH_2$]

Q.5 In the following allylic monobromination, reaction the number of possible chiral products is…….



SPACE FOR ROUGH WORK

SUBJECT - II (PHYSICS)	62 MARKS

SECTION - I [TYPE-1]

SINGLE CORRECT ANSWER TYPE

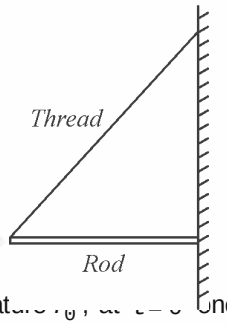
This section contains 5 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

Q.1 A scientist made a new kind of vernier callipers where there are 20 divisions of vernier scale matching with 17 *mm* of main scale. While measuring a diameter of a ball he founds that ZERO of vernier scale is just ahead of 25 *mm* of main scale and 12^{th} line of vernier scale coincides. Then:

(A) Diameter of the ball is $25.2mm$ **(B)** Diameter of the ball is $25mm$

(C) Diameter of ball is 25.8 *mm* **(D)** Diameter of ball is 26.8 *mm*

Q.2 A uniform rod of length 4m is kept against a wall by means of a thread of length 5m as shown in the figure. What should be the minimum friction coefficient between wall and rod such that it may not slip?



(A) $\frac{1}{4}$ **(B)** $\frac{1}{2}$

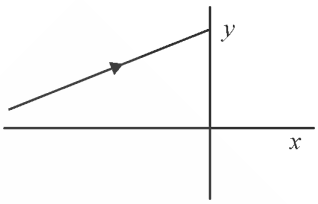
(C) $\frac{3}{4}$ **(D)** $\frac{4}{5}$

Q.3 A uniform rod of mass m and specific heat capacity s is kept at room temperature T_0, at $t=0$ one end of the rod was maintained at temperature $2T_0$ and the other end at T_0 and left to reach steady state. What is the total heat absorbed by the rod while reaching the steady state ?

(A) $2msT_0$ **(B)** msT_0 **(C)** $\frac{msT_0}{2}$ **(D)** None of these

SPACE FOR ROUGH WORK

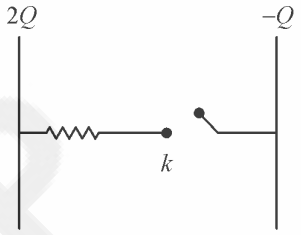
Q.4 A light ray travelling in *x*-*y* plane in a medium where $x > 0$ has refractive index as 1.6 and that of $x < 0$ is 1. The light ray travelling according to the equation $3y = 12 + 4x$ is incident on *y*-axis as shown. What is the equation of refracted ray ?



(A) $y + \frac{x}{\sqrt{3}} = 4$ **(B)** $y - \frac{x}{\sqrt{3}} = 4$

(C) $y + x = 4$ **(D)** $y - x = 4$

Q.5 Two plates parallel to each other kept as shown in the figure. One of them was given charge $+2Q$ and the other was given charge $-Q$. If capacitance of the system is *C*; what will be the total energy loss if the key k is closed ?



(A) $\frac{Q^2}{2C}$ **(B)** $\frac{2Q^2}{C}$

(C) $\frac{9Q^2}{8C}$ **(D)** None of these

SPACE FOR ROUGH WORK

SECTION - I [TYPE-2]

MULTIPLE CORRECT ANSWERS TYPE

This section contains 8 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:

Q.6 In a hydrogen like atom having atomic number Z the electron is revolving in n^{th} orbit around the nucleus. Then time period of the electron around the nucleus is proportional to :

(A) $\frac{n^2}{Z^3}$ **(B)** $\frac{n^3}{Z^2}$ **(C)** $\frac{n^2}{Z}$ **(D)** $\frac{n}{Z^2}$

Q.7 A string of length l fixed at both ends. Origin is taken at one of its end and *x*-axis along the string. Amplitude of an antinode is "a" and $x = \frac{l}{6}$ is a node then :

(A) $x = \frac{l}{4}$ may be a node **(B)** $x = \frac{l}{4}$ may be an antinode

(C) The string is vibrating in 6^{th} Harmonic **(D)** $x = \frac{l}{2}$ will always be a node

Q.8 Temperature of a point (x, y, z) in space is given as $T = (x-4)^2 + (y-3)^2 + z^2$. A person is standing at a point (7, 7, 5) If the person moves with velocity $\vec{v}$ then :

(A) If $\vec{v} = 3\hat{i} + 2\hat{j} - 3\hat{k}$, temperature will increase

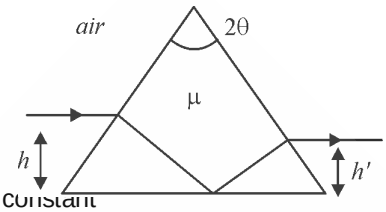
(B) If $\vec{v} = 3\hat{i} + 2\hat{j} - 3\hat{k}$, temperature will decrease

(C) If $\vec{v} = 3\hat{i} + 2\hat{j} - 4\hat{k}$, temperature will increase

(D) If $\vec{v} = 3\hat{i} + 2\hat{j} - 4\hat{k}$, temperature will decrease

SPACE FOR ROUGH WORK

Q.9 A glass prism of refractive index μ and angle of prism is 2θ, rest of the two angles are equal and the base length is *L*. A light ray coming parallel to the base is incident on one face and emerges from the other as shown. Then :



(A) The above phenomenon is true for all value of μ

(B) The above phenomenon is true for certain values of μ only

(C) $h + h' =$ constant **(D)** $h - h' =$ constant

Q.10 When a point source of monochromatic light is at a distance of 1m from a photo electric cell, the cut off voltage and the saturation current are 0.8 V and 16 mA respectively. If the same source is placed 2m away from the same cell, then :

(A) Stopping potential will be $0.4\,V$ **(B)** Stopping potential will be $0.8\,V$

(C) Saturation current will be $16\,mA$ **(D)** Saturation current will be $4\,mA$

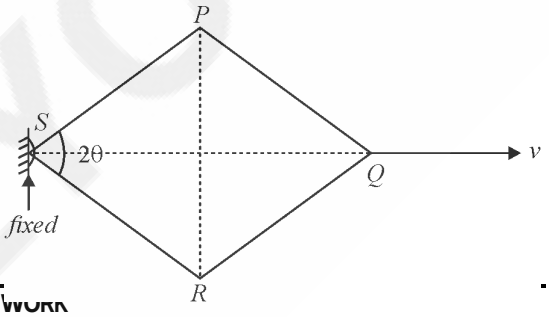
Q.11 4 rods of length *l* are hinged to form a rhombus. One of the corner is held fixed and the opposite corner is given a constant velocity v as shown in the figure. 2θ is the angle made by the rods at the fixed corner. A magnetic field B_0 exists perpendicular to the plane of rhombus. Then

(A) Angular velocity of rod PS is $\frac{v}{2l\sin\theta}$

(B) Angular velocity of rod PS is $\frac{v}{2l\cos\theta}$

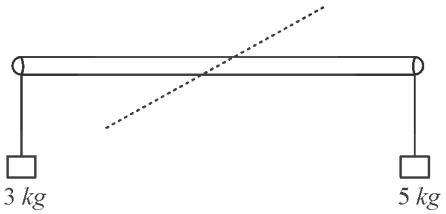
(C) Total emf induced is the loop is $Blv\frac{\cos 2\theta}{\cos\theta}$

(D) Total emf induced is the loop is $Blv\frac{\cos 2\theta}{\sin\theta}$



SPACE FOR ROUGH WORK

Q.12 A uniform rod of length $2m$ is hinged from the centre such that it can rotate is a vertical plane. 2 masses 5 *kg* and 3 *kg* are hung from its ends as shown in the figure. The angular acceleration of the rod just after releasing it will be : (Given $g = 10m/sec^2$)



(A) If the rod is massless is $5 rad/sec^2$

(B) If the rod is massless is $2.5 rad/sec^2$

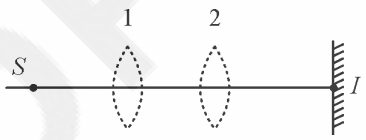
(C) If the rod has mass 6 kg is $4 rad/sec^2$

(D) If the rod has mass 6 kg is $2 rad/sec^2$

Q.13 An object S and a screen are kept fixed at a certain distance and a convex lens is moved between them such that principle axis of lens is perpendicular on the screen and passing from S as shown in order to get a sharp image we get two position of lens 1 & 2. For position 1 of the lens, magnification of image is m_1 and height is h_1 and for position 2 magnification is m_2 and height is h_2 . Then (h_0 represents height of object)

(A) $m_1 m_2 = 1$ **(B)** $\frac{m_1}{m_2} = 1$

(C) $h_0 = \sqrt{\frac{m_1}{m_2} h_1 h_2}$ **(D)** $h_0 = \sqrt{h_1 h_2}$



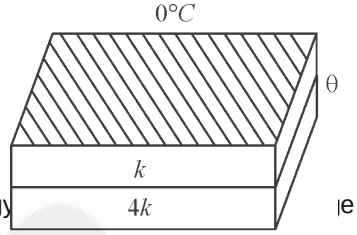
SPACE FOR ROUGH WORK

SECTION - II

SINGLE INTEGER VALUE CORRECT TYPE

This section contains 5 single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

Q.1 Two identical blocks are kept over each other having thermal conductivity of 4 *k* and *k* as shown in the figure. One of the surface is maintained at temperature 10°C and the other at 0°C. What is the temperature of the junction in °C?

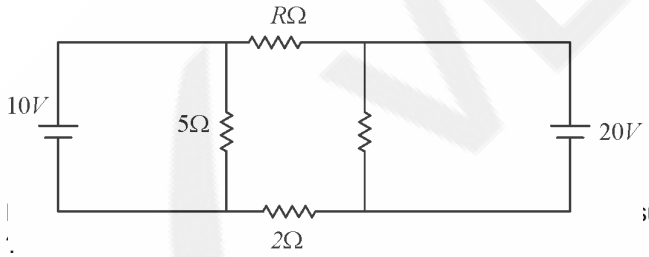


Q.2 It is estimated that in an atomic bomb explosion $8\times10^{13}J$ of energy is released. If $200MeV$ energy is released on fission of one $_{92}U^{235}$ atom. Total number of atoms is $\frac{k}{2}\times10^{24}$ atoms. What is the value of *k* ?

Q.3 An α particle (mass = 4 amu) strikes an atom at rest. The de Broglie wavelength of the α particle increases form λ to 3λ. If de Broglie wavelength of the atom after striking is $\frac{3\lambda}{2\sqrt{2}}$ then calculate the mass of atom in amu. Consider elastic collision.

Q.4 A container filled with a fluid of density ρ_0 has a height of 2*m*. A very small ball of density $\frac{2\rho_0}{9}$ is released from the base of container. Till what height the ball will reach above the fluid surface in meters ?

Q.5



such that there is no current through 10*V* cell

SPACE FOR ROUGH WORK

SUBJECT - III (MATHEMATICS)	62 MARKS

SECTION - II

SINGLE CORRECT ANSWER TYPE

This section contains 5 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

Q.1 Suppose $f(x)=3x^3-13x^2+14x-2$ *and* α,β,γ are roots of $f(x)=0$ such that $\alpha<\beta<\gamma$ then $\tan^{-1}([\alpha])+\tan^{-1}([\beta-1])+\tan^{-1}([\gamma-1])=$ (Where [.] denotes G.I.F)

(A) $\frac{3\pi}{4}$ (B) π (C) $\frac{\pi}{2}$ **(D)** can't be decided

Q.2 For a finite set *A*, let $|A|$ denote the number of elements in *A*. Let *F* denote the set of all functions $f:\{1,2,3,---,n\}\to\{1,2,3,----k\}(n\geq 3,k\geq 2)$ satisfying $f(i)\neq f(i+1)$ for every $i,1\leq i\leq n-1$ and $C(n,k)$ denote the number of functions in *F* satisfying $f(n)\neq f(1)$. Then For $n\geq 3, C(n,k)=$

(A) $(k-1)^{n-1}+(-1)^n(k-1)$ **(B)** $(k-1)^n+(-1)^n(k-1)$

(C) $(k-1)^n+(-1)^{n-1}(k-1)$ **(D)** $(k-1)^{n-1}+(-1)^{n-1}(k-1)$

Q.3 The number of points inside or on the circle $x^2+y^2=4$, satisfying $\tan^4 x+\cot^4 x+1=3\sin^2 y$ is:

(A) 1 **(B)** 2 **(C)** 4 **(D)** infinite

Q.4 A number is chosen at random from the set of all 4-digit numbers each of which contains not more than 2 different digits, probability that it does not contain the digit zero is :

(A) $\frac{7}{64}$ **(B)** $\frac{37}{64}$ **(C)** $\frac{47}{64}$ **(D)** $\frac{57}{64}$

Q.5 $S=\{a^{b^c};a,b,c\in\{\tan x,\cot x\}$, for some given $x\in\left(0,\frac{\pi}{4}\right)$ if all the elements of *S* are written in ascending order, then the number of elements of *S* lie between $(\cot x)^{(\cot x)^{(\tan x)}}$ and $(\tan x)^{(\tan x)^{(\tan x)}}$ is/are :

(A) 1 **(B)** 3 **(C)** 4 **(D)** 5

SPACE FOR ROUGH WORK

SECTION - I [TYPE-2]

MULTIPLE CORRECT ANSWERS TYPE

This section contains 8 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:

Q.6 Suppose 'f' and 'g' are functions having second derivatives f'' and g'' everywhere, if $f(x)\cdot g(x)=1$ for all 'x' and f' and g' are never zero, then $\frac{f''(x)}{f'(x)}-\frac{g''(x)}{g'(x)}$ equals :

(A) $\frac{-2f'(x)}{f(x)}$ **(B)** $\frac{-2g'(x)}{g(x)}$ **(C)** $\frac{-f'(x)}{f(x)}$ **(D)** $\frac{2f'(x)}{f(x)}$

Q.7 Let 'f' be a real valued function defined on the interval $(0,\infty)$ by $f(x)=\ln x+\int_0^x\sqrt{1+\sin t}\,dt$. Then which of the following statement(s) is/are true ?

(A) $f'(x)$ exists for all $x\in(0,\infty)$ and f' is continuous on $(0,\infty)$, but not differentiable on $(0,\infty)$

(B) $f''(x)$ exists for all $x\in(0,\infty)$

(C) There exists $\alpha>1$ such that $|f'(x)|<|f(x)|$ for all $x\in(\alpha,\infty)$

(D) There exists $\beta>0$ such that $|f(x)|+|f'(x)|<\beta$ for all $x\in(0,\infty)$

Q.8 If the solution of $y\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2=x$, $y(0)=y(1)=1$ is given by $y^2=f(x)$ then :

(A) $f(x)$ is monotonically increasing $\forall x\in(1,\infty)$ **(B)** $f(x)=0$ has only one root

(C) $f(x)$ is neither even nor odd **(D)** $f(x)$ has 3 real roots

SPACE FOR ROUGH WORK

Q.9 Let ABC be a triangle with $\angle BAC = 120^0$ and $AB \cdot AC = 1$. Also, let AD be the length of the angle bisector of angle 'A' of the triangle. Then

(A) Minimum value of AD is $\frac{1}{2}$

(B) Maximum value of AD is $\frac{1}{2}$

(C) AD is minimum when ΔABC is isosceles

(D) AD is maximum when ΔABC is isosceles

Q.10 There are two $n \times n$ square matrices A and B and a non-singular matrix P such that $P^{-1}BP = A$ and $|A| = |adj(adj(Q))|$, where, $Q = \begin{bmatrix} 1 & 1 & 0 \\ -2 & 1 & -1 \\ 1 & 2 & 3 \end{bmatrix}$, then :

(A) $|B| = 10^{-4}$ **(B)** $|A| + |B| = 2 \times 10^4$ **(C)** $|B| = 10^3$ **(D)** $|A| = 10^4$

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Q.11 From a point 'A' common tangents are drawn to the circle $x^2 + y^2 = 2$ and parabola $y^2 = 8x$. Then which of the followings are correct :

(A) Equation of one of the common tangents is y = x + 2.

(B) Equation of chord of contact of the pair of tangents drawn from the point A for the parabola $y^2 = 8x$ is $x = 2$

(C) Equation of chord of contact of the pair of tangents drawn from the point A for the circle $x^2 + y^2 = 2$ is $x = -1$

(D) Area of the quadrilateral formed by the common tangents, the chord of contact of the circle and the chord of contact of the parabola is 15

Q.12 Let $'n'$ be the number of points with integral coordinates, which lie interior of the circle $x^2 + y^2 = a^2$, $a \neq 0$. The value of $'n'$ cannot be equal to :

(A) 68 **(B)** 103 **(C)** 70 **(D)** 85

Q.13 Let $\vec{a}$ and $\vec{b}$ be two non-collinear unit vectors. If $\vec{u} = \vec{a} - (\vec{a} \cdot \vec{b})\vec{b}$ and $\vec{v} = \vec{a} \times \vec{b}$, then $|\vec{v}|$ is :

(A) $|\vec{u}|$ **(B)** $|\vec{u}| + |\vec{u} \cdot \vec{a}|$

(C) $|\vec{u}| + |\vec{u} \cdot \vec{b}|$ **(D)** $|\vec{u}| + \vec{u} \cdot (\vec{a} + \vec{b})$

SPACE FOR ROUGH WORK

SECTION - II

SINGLE INTEGER VALUE CORRECT TYPE

This section contains 5 single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

Q.1 If $f(n)=\sum_{r=1}^{n}\left[r\left(n\cdot{}^{n-1}C_{r-1}-r\cdot{}^{n}C_{r-1}\right)+(2r+1)\,{}^{n}C_{r}\right]$, then $\dfrac{\left(\sum_{n=1}^{10}f(n)\right)-95}{80}$ is equal to :

Q.2 A square matrix P satisfies $P^2=I-P$ where I is identity matrix. If $P^n=51-8P$ then n is equal to :

Q.3 Let $f(x)$ be a continuous function which takes positive values for $x\geq 0$ and $\int_0^x f(t)\,dt=x\sqrt{f(x)}$ with $f(1)=\dfrac{1}{2}$. Then the value of $4f\left(\sqrt{2}+1\right)$ is equal to :

Q.4 Let $f(x)=\lim\limits_{n\to\infty}\ell n\left(\sqrt{e^{\cos x}\sqrt{e^{3\cos x}\sqrt{e^{5\cos x}\ldots\ldots\sqrt{e^{(2n-1)\cos x}}}}}\right)$. If $g(x)=\left[\dfrac{1}{3}f(x)\right]$, then number of points in $[0,2\pi]$ where $g(x)$ is discontinuous is _____

$[[\cdot]$ denotes greatest integer function$]$

Q.5 If $A_0=\begin{bmatrix}2&-2&-3\\-1&3&4\\2&-2&-3\end{bmatrix}$ and $B_0=\begin{bmatrix}-4&-3&-3\\1&0&1\\4&4&3\end{bmatrix}$, $B_n=adj\left(B_{n-1}\right)$, $n\in N$ and I is an identity matrix of order 3, then $\det\left(A_0B_0+A_0^2B_1^2+A_0^3B_2^3+A_0^4B_3^4+\ldots\ldots\text{up to 10 terms}\right)$ is equal to_____

SPACE FOR ROUGH WORK

End of Mock JEE Advanced-6 | PAPER-1