Vidyamandir Classes
Gurukul for IITJEE Preparation

Advanced Practice Test-3

TIME : 3 hrs	M.M. : 180

Read the following Instructions very carefully before you proceed.

1. The question paper consists of 3 parts (Part I : Chemistry, Part II : Physics, Part III : Mathematics). Each Part has 2 sections (Section I & Section II).

2. **Section I** contains **10 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*]

3. **Section II** contains **10 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 candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc., except the Admit Card inside the examination hall/room.

6. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. However, the candidates are allowed to take away this Test Booklet with them.

PART - I (CHEMISTRY)	60 MARKS

SECTION-I

SINGLE CORRECT ANSWER

This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

1. The first ionisation potential of Al is smaller than that of Mg because:

(A) The atomic size of Al > Mg **(B)** The atomic size of Al < Mg

(C) Al has one unpaired electron in p-orbital **(D)** The atomic number of Al > Mg

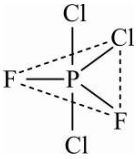
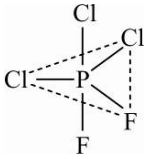
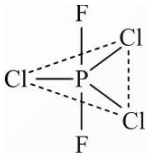
2. Which of the following can be used to discriminate between reversible and irreversible expansion of an ideal gas under isothermal conditions ?

(A) ΔU **(B)** ΔH **(C)** ΔS_{Total} **(D)** None of these

3. The number of photons emitted in 10 hours by a 60 W sodium lamp emitting radiations of wavelength 6000 Å is :

(A) 6.5×10^{24} **(B)** 6.5×10^{34} **(C)** 1.8×10^{31} **(D)** 1.8×10^{21}

4. The struture of PCl_3F_2 is :

(A)  **(B)**  **(C)**  **(D)** All are correct

5. 1.0 gm each of Mg (Atomic weight = 24) and 'O_2' (Molecular weight = 32) are reacted to form compound MgO. Then :

I. Mg is the limiting reagent. **II.** O_2 is the limiting reagent.

III. No reactant is left over.

IV. Mass of MgO formed is same as the mass of Mg taken.

V. Moles of reagent in excess are 1/96. **VI.** Moles of product formed are 1/24.

The correct choice is :

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

6. A solution contains x mmol Na_2CO_3 and y mmol $NaHCO_3$, 10 mL of the solution requires 2.5 mL of 0.1 M H_2SO_4 for neutralization using phenolphthalein as the indicator. Methyl orange is then added when a further 2.5 ml of 0.2 M H_2SO_4 was required. Find mole ratio of Na_2CO_3 and $NaHCO_3$ $\left(\frac{x}{y}\right)$:

(A) 1 **(B)** 0.5 **(C)** 2 **(D)** None of these

7. In which of the following case(s) entropy increases ?

I. Stretching a rubber band **II.** Boiling of egg

III. Conversion of O_2 to O_3

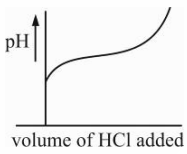
The correct choice is :

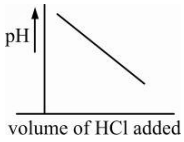
(A) II, III **(B)** Only II **(C)** I, III **(D)** I, II

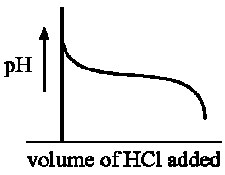
8. One mole of an ideal monoatomic gas expands isothermally against constant external pressure of 1 atm from initial volume of 1 L to a state where its final pressure becomes equal to external pressure. If initial temperature of gas is 300 K then total entropy change of system in the above process is : [R = 0.082 L atm mol^{-1} K^{-1} = 8.3 J mol^{-1} K^{-1}]

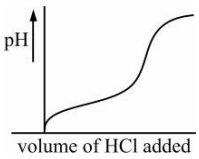
(A) 0 **(B)** $R\ell n(24.6)$ **(C)** $R\ell n(2490)$ **(D)** $\frac{3}{2} R\ell n(24.6)$

9. When 100 ml of 0.1 M NaCN solution is titrated with 0.1 M HCl solution the variation of pH of solution with volume of HCl added will be :

(A) 

(B) 

(C) 

(D) 

10. The correct relation between Methyl acetate and Ethyl formate is :

(A) Metamers **(B)** Chain isomers

(C) Position isomers **(D)** Functional isomers

SECTION - II
SINGLE INTEGER VALUE CORRECT TYPE

This section contains 10 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.

1. $MnO_2 + 2KClO_3 \longrightarrow K_2MnO_4 + Cl_2 + 2O_2$

$Cl_2 + K_2MnO_4 \longrightarrow 2KCl + MnO_2 + O_2$

Each reaction takes place to the extent of 50%. 11.2 L of O_2 at STP is obtained from $\frac{X}{10}$ moles of $KClO_3$. The value of X is _____.

2. How many of the following have sp^3 hybridization ?

PCl_3, NCl_3, NF_3, NH_3, ClF_3, CH_2Cl_2, BCl_3, BBr_3

3. The number of possible primary alcohols with the formula $C_6H_{14}O$ is _____.

4. Among the following, the number of ions containing sulphur-sulphur linkage is :

$S_2O_3^{2-}$, $S_4O_6^{2-}$, $S_2O_6^{2-}$, $S_2O_8^{2-}$, $S_2O_5^{2-}$, $S_2O_7^{2-}$

5. If uncertainties in measurement of position and momentum of an electron are equal, then the uncertainty in measurement of its velocity is $x \times 10^{12}$. The value of *x* (the closest whole number value) is _____. $\left(\text{take } \sqrt{\frac{h}{4\pi}} = 0.728\right)$ $(m_e = 9.1 \times 10^{-31}\text{kg and } h = 6.625 \times 10^{-34}\text{ Js.})$

6. How many of the following will give positive iodoform test?

(1)	Formaldehyde	**(2)**	Acetaldehyde	**(3)**	Acetone
(4)	Benzaldehyde	**(5)**	Benzophenone	**(6)**	Acetophenone
(7)	2-Methyl cyclohexanone	**(8)**	Ethanol	**(9)**	tert-Butyl alcohol

7. How may of the following combination can act as buffer.

(1)	$HCl + NaOH$	**(2)**	$HCl + CH_3COO^- Na^+$	**(3)**	$H_2SO_4 + NaHSO_4$
(4)	$H_2CO_3 + NaOH$	**(5)**	$NaOH + Ph - CO_2H$	**(6)**	$HBr + NH_4OH$
(7)	$CH_3COOH + NH_4OH$	**(8)**	$NaOH + NH_4OH$	**(9)**	$HCl + CH_3COOH$

8. Teeth enamel is largely hydroxyapatite $Ca_5(PO_4)_3OH$, when dissolve in water it dissociates to give Ca^{2+}, PO_4^{3-} and OH^- with a degree of dissociation is 0.5. The ratio of the observed colligative properties of the aqueous solution to the value of colligative properties in the absence of ionic dissociation is _____.

9. At 25°C, the standard enthalpy of formation of HF(aq) is given by –320.1 kJ/mol; of OH^-(aq) it is –229.6 kJ/mol; of F^-(aq) it is –329.1 kJ/mol; and of H_2O(l), it is –285.8 kJ/mol. If the standard enthalpy change for the reaction $H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O(l)$ is –56.2 kJ then the standard enthalpy change for the reaction $HF_{(aq)} \longrightarrow H^+_{(aq)} + F^-_{(aq)}$ will be –x kJ/mol. The numerical value of x is _____.

10. The weight percent (W/V) of sucrose (Molecular weight = 342 g mol^{-1}) in an aqueous solution is 34.2. The density of the solution is 1 g/ml, the concentration of sucrose in the solution in mol L^{-1} is equal to _____.

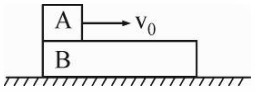
PART - II (PHYSICS)	60 MARKS

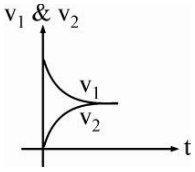
SECTION-I

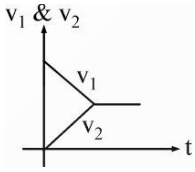
SINGLE CORRECT ANSWER

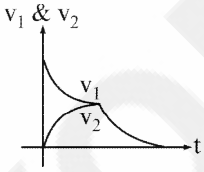
This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

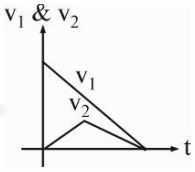
1. A block A is placed over a long rough plank B same mass as shown below. The plank is placed over a smooth horizontal surface. At time $t = 0$, block A is given a velocity v_0 in horizontal direction. Let v_1 and v_2 be the velocity of A and B at time 't'. Then choose the correct graph between v_1 or v_2 and t.



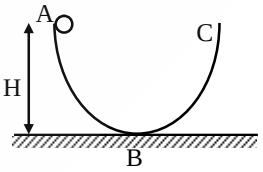
(A) 

(B) 

(C) 

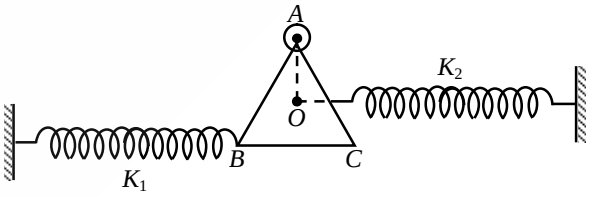
(D) 

2. A solid sphere of mass m and radius r is released from rest at point A on a track in vertical plane. The track is rough enough to support rolling without slipping between A and B and form B onwards it is smooth. The maximum height attained by sphere from ground on its journey from B onwards is : ($r << H$)



(A) H **(B)** $\frac{5}{7}H$ **(C)** $\frac{2}{5}H$ **(D)** $\frac{2}{7}H$

3. A uniform equilateral frame in vertical plane having mass $3m$ and length at each side ℓ is hinged at A. Two ideal massless spring of force constant K_1 and K_2 are attached as shown in the figure. The frequency of vibration in the plane of frame is : (O is centroid)



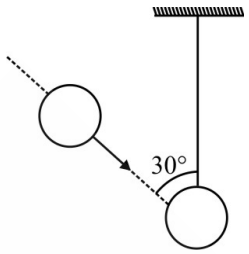
(A) $\frac{1}{2\pi}\sqrt{\frac{2}{3}\left(\frac{3k_1}{4m}+\frac{k_2}{3m}+\frac{\sqrt{3}\,g}{\ell}\right)}$ **(B)** $\frac{1}{2\pi}\sqrt{2\left(\frac{3k_1}{2m}+\frac{k_2}{3m}+\frac{\sqrt{3}\,g}{2\ell}\right)}$

(C) $\frac{1}{2\pi}\sqrt{\frac{1}{3}\left(\frac{3k_1}{2m}+\frac{k_2}{2m}+\frac{\sqrt{3}\,g}{2\ell}\right)}$ **(D)** $\frac{1}{2\pi}\sqrt{\frac{3}{2}\left(\frac{3k_1}{2m}+\frac{3k_2}{m}+\frac{\sqrt{3}\,g}{2\ell}\right)}$

4. A liquid of volumetric thermal expansion coefficient r and bulk modulus B is filled in a spherical tank of negligible heat expansion coefficient and radius R and wall thickness is 't' ($t << R$). When the temperature of liquid is raised by θ. The tensile stress developed in the walls of tank is :

(A) $\frac{Br\theta R}{2t}$ **(B)** $\frac{Br\theta R}{t}$ **(C)** $\frac{2Br\theta R}{t}$ **(D)** $\frac{Br\theta R}{4t}$

5. A smooth sphere of mass 1 *kg* is tied to a fixed point by an inextensible string and suspended from the roof. Another identical sphere impinges directly on it with speed 5 *m/s* in a direction making an acute angle 30° with the string. Co-efficient of restitution is $\frac{1}{2}$. Velocity of the suspended sphere just after collision is :



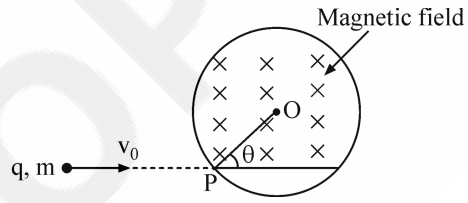
(A) 3 *m/s* **(B)** 5 *m/s* **(C)** 2 *m/s* **(D)** 1 *m/s*

6. The displacement *x* of a particle varies with time *t* as: $x = ae^{-\alpha t} + be^{\beta t}$ where *a*, *b*, α and β are positive constants. The velocity of the particle will :

(A) be independent of β **(B)** drop to zero when $\alpha = \beta$

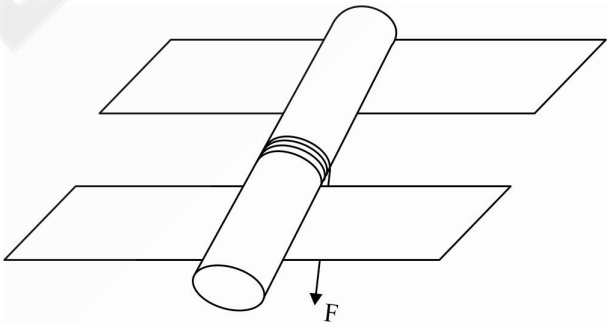
(C) go on decreasing with time **(D)** go on increasing with time

7. A particle of charge *q* and mass *m* is projected with a velocity v_0 towards a circular region having uniform magnetic field *B* perpendicular and into the plane of paper from point *P* as shown in figure. *R* is the radius and *O* is the centre of the circular region. If the line *OP* makes an angle θ with the initial line of motion then the value of v_0 so that particle passes through *O* is :



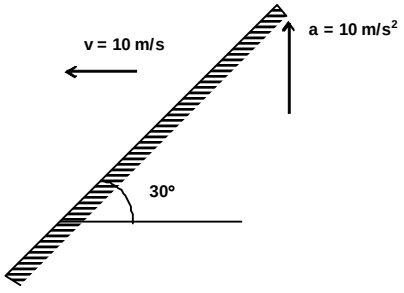
(A) $\frac{qBR}{m\sin\theta}$ **(B)** $\frac{qBR}{2m\sin\theta}$ **(C)** $\frac{2qBR}{m\sin\theta}$ **(D)** $\frac{3qBR}{2m\sin\theta}$

8. A uniform solid cylinder of mass *m* rests on two horizontal planks. A thread is wound to the cylinder. The hanging end of the thread is pulled vertically down with a constant force F(see fig.). Find the maximum magnitude of the force '*F*' which still does not bring any sliding of the cylinder, if the coeff. of friction between the cylinder and planks is equal to μ.



(A) $\frac{2\mu gm}{2-3\mu}$ **(B)** $\frac{\mu gm}{2-\mu}$ **(C)** $\frac{3\mu gm}{2-3\mu}$ **(D)** $\frac{2\mu gm}{2-\mu}$

9. A particle is thrown horizontally with relative velocity 10 m/s from a big inclined plane, which is also moving with acceleration 10 m/s^2 vertically upward. The time after which it lands on the plane : (Take g = 10 m/s^2)



(A) 1 sec **(B)** 2 sec

(C) $\frac{1}{2}$ sec **(D)** $\frac{1}{\sqrt{3}}$ sec

10. A soap bubble of radius 3 cm and thickness 10^{-2} mm is charged to a potential of 0.3 volt. The bubble burst and falls as a spherical drop. Determine the potential of the drop.

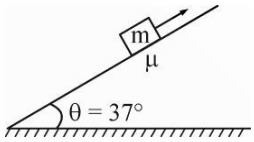
(A) 3 volts **(B)** 6 volts **(C)** 9 volts **(D)** 12 volts

SECTION - II

SINGLE INTEGER VALUE CORRECT TYPE

This section contains 10 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.

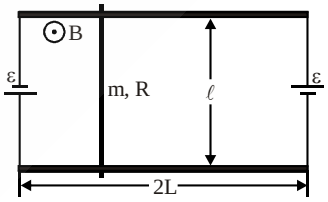
1. A block of mass *m* is being pulled up the rough incline, inclined at an angle $37°$ with horizontal by an agent delivering constant power *P*. The coefficient of friction between the block and the incline is μ. Find the maximum speed (in *m*/*s*) of the block during the course of ascent. [Take : P = 60 *W*, *m* = 1 *kg*, $\mu = 0.5$]



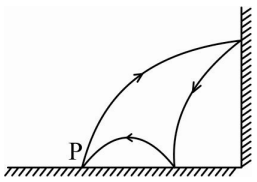
2. A satellite is describing a circular orbit around a massive planet of radius *R*. The altitude of the satellite above surface of planet is 3*R* and its speed is V_0. To place the satellite in an elliptical orbit which will bring it closer to the planet, its velocity is reduced from V_0 to βV_0, when $\beta < 1$. The smallest permissible value of β if satellite is not to crash on the surface of planet is $\sqrt{\frac{2}{K}}$, find *K*.

3. Side rail of length 2L are fixed on a horizontal plane at a distance ℓ from each other. These ends are connected by two identical ideal batteries with emf E by resistanceless wires (see figure). On the rails is a rod of mass *m*, which may slide along them. The entire system is placed in a uniform vertical magnetic field B.

Assuming that the resistance of the rod is R and the resistance per unit length of each of the rails equal to ρ, find the period of small oscillations (in sec.) arising from shifting the rod from the equilibrium along the rails. Neglect friction, internal resistance of batteries and induced emf in the rod. [Take : B = πT, $\varepsilon = \pi$ volt, ℓ = 0.5*m*, L = 1*m*, ρ = 1Ω/*m*, R = 0.25 Ω, *m* = 100 *gm*]



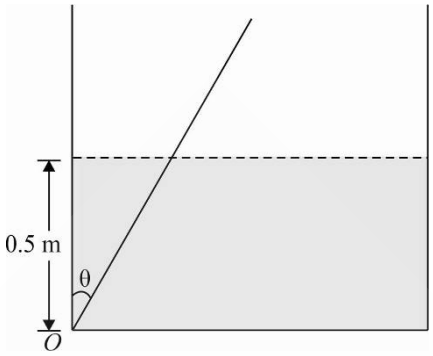
4. A small ball is projected from point *P* on floor towards a wall as shown. It hits the wall when its velocity is horizontal. Ball reaches point *P* after one bounce on the floor. If the coefficient of restitution is the same for the two collisions, find the value of its reciprocal. [All surfaces are smooth].



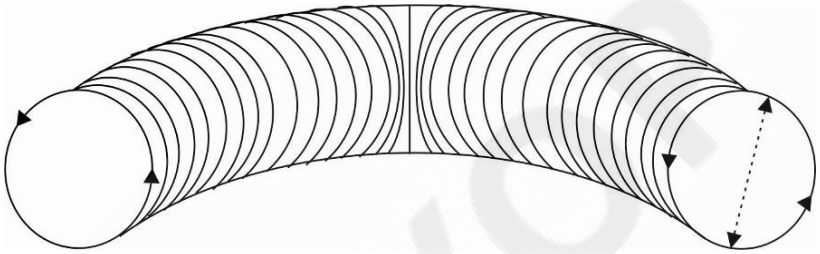
5. During a rainy day, rain is falling vertically with a velocity 2m/s. A boy at rest starts his motion at time $t = 0$ with a constant acceleration of $2\,\text{m/s}^2$, along a straight horizontal road. At $t = \frac{1}{3}$s, the rate at which the angle of the axis of the umbrella with the vertical should be changed, so that the rain always falls parallel to the axis of the umbrella is $\frac{a}{10}$rad/s. Find *a*.

6. A neutral particle is at rest in a uniform magnetic field $\vec{B}$. At $t = 0$, particle decays into two particles each of mass '*m*' and one of them having charge '*q*'. Both of these move off in separate paths lying in plane perpendicular to $\vec{B}$. At later time, the particles collide. If this time of collision neglecting the interaction force is $\frac{a\pi m}{qB}$, find *a*.

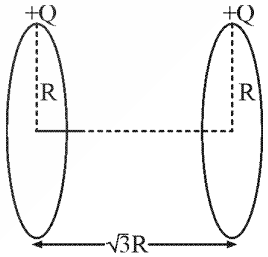
7. A wooden plank of length 1 m and uniform cross section is hinged at one end to the bottom of a tank as shown in the figure. The tank is filled with water up to a height of 0.5 m. The specific gravity of the plank is 0.5. θ is angle which plank makes with the vertical in the equilibrium position (exclude the case θ = 0). Find the value of $\frac{1}{\cos^2\theta}$.



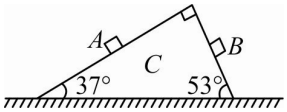
8. Calculate the magnetic moment (in Am^2) of a thin wire with a current I = 8.0 A, would tightly on a half a tore (see figure). The diameter of the cross section of the tore is equal to *d* = 5.0 *cm*, and the number of turns in N = 500.



9. Two identical charged rings of charge $Q = 1\,C$ and radius R = 0.1*m* are separated by a distance $\sqrt{3}\,R$ meter, and are fixed. A point charge of charge $q = 1.0\times10^{-9}\,C$ and mass *m* = 2 *kg* is moved by external agent from the centre of left ring to the centre of right ring. Find the work done by an external agent in joule.



10. In the figure shown blocks '*A*' and '*B*' are kept on a wedge '*C*'. *A*, *B* and *C* have mass *m*. All surfaces are smooth. Find the acceleration of *C*.



PART - III (MATHEMATICS)	**60 MARKS**

SECTION-I

SINGLE CORRECT ANSWER

This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

1. All functions $f : R \to R$ which obey the equation $f\left((x-y)^2\right) = \left(f(x)\right)^2 - 2x.f(y) + y^2$ are :

(A) Continuous in *R* **(B)** Not differentiable in *R*

(C) Monotonic decreasing in *R* **(D)** They have both maxima and minima

2. If *a*, *b*, *c* and *d* are the solutions of the equation $x^4 - bx - 3 = 0$, then an equation whose solutions are $\frac{a+b+c}{d^2}, \frac{a+b+d}{c^2}, \frac{a+c+d}{b^2}$, and $\frac{b+c+d}{a^2}$, is :

(A) $3x^4 + bx + 1 = 0$ **(B)** $3x^4 - bx + 1 = 0$

(C) $3x^4 + bx^3 - 1 = 0$ **(D)** $3x^4 - bx^3 - 1 = 0$

3. $\lim\limits_{x\to\infty}\left(\left(\dfrac{1+\tan\dfrac{\pi}{2x}}{1+\sin\dfrac{\pi}{x}}\right)^{x}+\left(\dfrac{2}{\pi}\cos^{-1}\dfrac{1}{x}\right)^{\frac{x\pi^2}{4}}\right)$ equals :

(A) $e^{-\frac{\pi}{2}}$ **(B)** $e^{-\pi}$ **(C)** $2e^{-\pi}$ **(D)** $2e^{-\frac{\pi}{2}}$

4. Let $x_1=\sqrt{2}$, $x_2=\sqrt{2+\sqrt{2}}$, $x_3=\sqrt{2+\sqrt{2+\sqrt{2}}}$ ....., $x_n=\sqrt{2+\sqrt{2+\sqrt{2+}}}$ .....n (times).

Then $2\sin\left(1+\dfrac{1}{2}+\dfrac{1}{4}+\dfrac{1}{8}+.....+\dfrac{1}{2^{2005}}\right)45^{o}$ must be :

(A) x_{2007} **(B)** x_{2006} **(C)** x_{2005} **(D)** x_{2008}

5. If $1,\alpha_1,\alpha_2.....\alpha_{n-1}$ are the nth roots of unity then $\dfrac{1}{2-\alpha_1}+\dfrac{1}{2-\alpha_2}+.....+\dfrac{1}{2-\alpha_{n-1}}$ is :

(A) $\dfrac{(n-2)2^{n-1}+1}{2^n-1}$ **(B)** $\dfrac{(n-2)2^{n}+1}{2^{n-1}-1}$ **(C)** $\dfrac{(n-1)2^{n}-1}{2^n-1}$ **(D)** $\dfrac{(n-1)2^{n-1}-1}{2^{n-1}-1}$

6. A circle with radius | a | and center on the y-axis slides along it and a variable line through (a, 0) cuts the circle at points P and Q. The region in which the point of intersection of the tangents to the circle at points P and Q lies, is represented by :

(A) $y^2\geq 4(ax-a^2)$ **(B)** $y^2\leq 4(ax-a^2)$ **(C)** $y\geq 4(ax-a^2)$ **(D)** $y\leq 4(ax-a^2)$

7. If foci of hyperbola lie on $y = x$ and one of the asymptotes is $y = 2x$, then equation of the hyperbola, given that it passes through (3, 4), is :

(A) $x^2-y^2-\dfrac{5}{2}xy+5=0$ **(B)** $2x^2-2y^2+5xy+5=0$

(C) $2x^2+2y^2-5xy+10=0$ **(D)** None of these

8. If [x] denotes the greatest integer not exceeding x and if the function f defined by :

$$f(x)=\begin{cases}\dfrac{a+2\cos x}{x^2} & (x<0)\\ b\tan\dfrac{\pi}{[x+4]} & (x\geq 0)\end{cases}$$ is continuous at $x = 0$, then the ordered pair (a, b) =

(A) $(-2, 1)$ **(B)** $(-2, -1)$ **(C)** $\left(-1, \sqrt{3}\right)$ **(D)** $\left(-2, -\sqrt{3}\right)$

9. The number of functions f from the set A = {0,1,2} in to the set B = {0,1,2,3,4,5,6,7} such that $f(i)\leq f(j)$ for $i<j$ and $i,j\in A$ is :

(A) ${}^8C_3$ **(B)** ${}^8C_3+2\left({}^8C_2\right)$ **(C)** ${}^{10}C_3$ **(D)** None of these

10. The set of real values of a for which sum of the roots of the equation $\dfrac{1}{x}+\dfrac{1}{a}-\dfrac{1}{a^2}=\dfrac{1}{x+a-a^2}$ is less than $a^3/4$ is :

(A) $(0,\infty)-\{1,2\}$ **(B)** $(3,\infty)$ **(C)** $(-1,0)\cup(3,\infty)$ **(D)** $(2,\infty)$

SECTION - II
SINGLE INTEGER VALUE CORRECT TYPE

This section contains 10 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.

1. If α and β are the roots of the equation $x^2 - p(x+1) - q = 0$, then the value of $\frac{\alpha^2+2\alpha+1}{\alpha^2+2\alpha+q} + \frac{\beta^2+2\beta+1}{\beta^2+2\beta+q}$ is _____. (**Hint**: You may use $(1+\alpha)(1+\beta) = 1+\alpha+\beta+\alpha\beta$)

2. The absolute value of the difference of the real roots of the equation
$x^2 - 2^{2010}x + \left| x - 2^{2009} \right| + 2\left(2^{4017} - 1\right) = 0$ is _____.

3. If α, β are two distinct real roots of the equation $ax^3 + x - 1 - a = 0$ $(a \neq -1, 0)$, none of which is equal to unity, then the value of $\lim\limits_{x \to (1/\alpha)} \frac{(1+a)x^3 - x^2 - a}{\left(e^{1-\alpha x} - 1\right)(x-1)}$ is $\frac{a\ell(k\alpha - \beta)}{\alpha}$. The value of $k\ell$ is _____.

4. Let $f : (-1, 1) \longrightarrow R$ be a differentiable function with $f(0) = -1$ and $f'(0) = 1$.
Let $g(x) = \left(f\left(2f(x) + 2\right)\right)^2$, then $\left|g'(0)\right|$ is equal to _____.

5. A differentiable function $f(x)$ satisfying $f(xy) = \left(f(x)\right)^y \; \forall x, y \in R$ and $f(1) = \frac{1}{4}$
If $\lim\limits_{n \to \infty} \left(1.\sqrt{f(x+1)} + 2.\sqrt{f(x+2)} + ... + n\sqrt{f(x+n)}\right) = k\sqrt{f(x)}$, then k is equal to _____.

6. The value of $\left[\lim\limits_{x \to \frac{\pi^-}{2}} (1+\tan x)\left\{(1+\tan x)\ln\left(\frac{1+\tan x}{2+\tan x}\right) + 1\right\} \right]$ is equal to _____. (Where [.] is G.I.F.)

7. If $\int_0^{\pi/2} \frac{dx}{3 + b\cos x} = \frac{1}{\sqrt{b^2 - 9}} \ln \frac{b + \sqrt{b^2 - 9}}{3}$, (where $b > 3$), then the value of $\int_0^{\pi/2} \frac{\cos x}{(3 + 5\cos x)^2} dx$ is $\frac{-1}{16} + \frac{3}{64}\log c$ then c is _____.

8. A firm of Charter Accountants in Bombay has to send 10 clerks to 5 different companies, two clerks in each. Two of the companies are in Bombay and the others outside. Two of the clerks prefer to work in Bombay while three others prefer to work outside. If number of ways in which assignment be made if the preferences are to be satisfied is *abcd* then $a + b + c + d$ is _____.

9. The equation of a line through the mid points of the sides AB and AD of rhombus ABCD, whose one diagonal is $3x - 4y + 5 = 0$ and one vertex is $A(3, 1)$, is $ax + by + c = 0$. Find the absolute value of $(a + b + c)$ where a, b, c are integers expressed in lowest form.

10. If $1, \alpha_1, \alpha_2, \alpha_3$ & α_4 be the roots of $x^5 - 1 = 0$ and ω be a complex root of unity, then the value of $\left(\frac{\omega - \alpha_1}{\omega^2 - \alpha_1} \cdot \frac{\omega - \alpha_2}{\omega^2 - \alpha_2} \cdot \frac{\omega - \alpha_3}{\omega^2 - \alpha_3} \cdot \frac{\omega - \alpha_4}{\omega^2 - \alpha_4}\right)$ is ω^b then the least positive value of b is _____.