Vidyamandir Classes
Gurukul for IITJEE Preparation

Advanced Practice Test-11

TIME : 3 hrs	M.M. : 306

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 Part has 3 sections (Section I, Section II & Section III).

2. **Section I** contains **10 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* [5 *Marks for All Correct answers &* ***–2 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* [4 *Marks for Correct answer &* ***NO NEGATIVE MARKING*** *for wrong answer*]

4. **Section III** contains **4 Match the columns type questions**. Each question contains statements given in 2 columns. Statements in the first column have to be matched with statements in the second column. The answers to these questions have to be appropriately bubbled in the answer sheet.

- *Marking scheme* [***8 Marks*** *if you darken ALL the bubbles corresponding ONLY to the correct answer or given* ***2 Marks*** *each for correct bubbling of answer in any row.* ***No Negative mark will be given for an incorrectly bubbled answer***]

5. 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.

6. 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.

SUBJECT - I (CHEMISTRY)	102 MARKS

SECTION-I

MULTIPLE CORRECT ANSWERS

This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct :

1. Which of the following is(are) correct?

(A) Glucose is a reducing monosaccharide

(B) One mole of glucose reacts with three mol of phenyl hydrazine to form glucosazone

(C) α-D-(+)- glucopyranose and β-D-(+)- glucopyranose are anomers of glucose

(D) Cellulose is a straight chain polysaccharide composed only of β-D-(+)- glucopyranose units

2. In which of the following reactions end product is benzene.

(A) $C_6H_5N_2^+Cl^- + C_2H_5OH \longrightarrow$ **(B)** $C_6H_5N_2^+Cl^- + H_3PO_2 + H_2O \longrightarrow$

(C) $C_6H_5COONa + NaOH \xrightarrow[\Delta]{CaO}$ **(D)** $C_6H_5OH + Zn \xrightarrow[\Delta]{}$

3. Which of the following pairs can be distinguished by haloform reaction with I_2/NaOH ?

(A) Propanal and Propanone **(B)** Acetophenone and Benzophenone

(C) Pentan-2-one and Pentan-3-one **(D)** Benzaldehyde and Acetophenone

4. Which of the following would be a useful reaction for preparing isobutyric acid $(CH_3)_2CHCOOH$?

(A) 2-methyl-1-propanol + Jone's reagent

(B) 2-bromopropane + CO_2; followed by H_2O_2

(C) *cis*-2, 5-dimethyl-3-hexene + O_3; followed by hydrolysis

(D) 2-bromopropane + NaCN; followed by acid catalysed hydrolysis

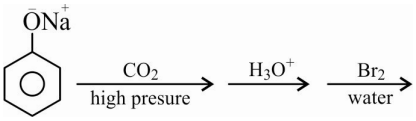
5. In which of the following entropy increases.

(A) Polymerisation of ethylene

(B) Conversion of white phosphorous into red phosphorous

(C) Dissolution of NaCl in water **(D)** Decomposition of $CaCO_3$

6. Check the sequence of reactions.



Pick the correct statement(s) about the final product.

(A) It is a white precipitate

(B) It can be generated by reacting phenol with Br_2 in CS_2 directly

(C) A similar type (not same) of product is formed when aniline reacts with Br_2 water

(D) It's a tetra-substituted benzene derivative

7. Which of the following is/are correctly matched ?

(A) α-D-glucose-β-D-fructose-(1,1′-link) ; Sucrose

(B) α-D-glucose-D-glucose-(1, 4′-link) ; Maltose

(C) β-D-glucose-D-glucose-(1, 4′-link) ; Cellulose

(D) β-D-galactose-α-D-glucose-(1,1′-link) ; Lactose

8. Which of the following compounds are more basic than aniline.

(A) **(B)** **(C)** **(D)**

9. The molecules/ions having $p\pi - d\pi$ bonds is(are) :

(A) SO_4^{2-} **(B)** NO_3^{-} **(C)** ClO^- **(D)** $N(SiH_3)_3$

10. Which of the following oxide cannot be reduced to metal by carbon?

(A) ZnO **(B)** Al_2O_3 **(C)** CuO **(D)** HgO

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. In the structure of borax, the number of B–O–B units are _____ .

2. How many molecular orbitals can be built from the valance shell orbitals in O_2 ?

3. Copper sulphate reacts with excess KCN to forms a cyano complex. Write the balanced equation and find out the number of mole of KCN molecules involved in the equation for one mole of $CuSO_4$?

4. The energy needed for the following process is 1.96×10^4 kJ/mol .

$$Li_{(g)} \longrightarrow Li^{3+}_{(g)} + 3e^-$$

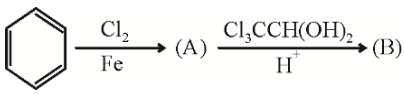
The first ionization energy of lithium is 520 kJ/mol and the second ionization energy is $x \times 10^y$ kJ/mol . What is the numerical value of y.

5. Compound (A) (C_6H_{14}) gives three different monochlorides on photo chemical chlorination. One of these monochlorides is inert to E_2 elimination. The other two monochlorides yield the same alkene (B) (C_6H_{12}) on being heated with potassium tert-butoxide in tert-butyl alcohol. Find out number of hyper-conjugable hydrogen atoms in alkene (B).

6. What is the co-ordination number of titanium ion in transition metal carbide, TiC, if the radii are r (Ti^{4+}) = 74.5 and r(C^{4-}) = 141.5 pm.

7. How many oxygen atoms are co-ordinated to central metal ion in complex $[Ca(EDTA)]^{2-}$?

8. Consider the synthesis of an organic compound (B) that contains 50% by mass chlorine.



How many stereoisomers are possible for organic compound (B)

9. Consider a buffer solution made of 0.500 M CH_3COOH and 0.500 M CH_3COONa solution, having pH equal to *x*. It's pH becomes *y* after 10 fold dilution. The value of $(x - y)$ is _____

10. The equilibrium constant K_{p_1} and K_{p_2} for the reactions :

$X(g) \rightleftharpoons 2Y(g)$ and $Z(g) \rightleftharpoons P(g) + Q(g)$;

respectively are in the ratio of 1 : 9. If the degree of dissociation of X and Z be equal, then calculate the value of $\sqrt{\frac{p_2}{p_1}}$. (Where P_1 and P_2 are equilibrium pressures)

SECTION - III

MATRIX MATCH TYPE

This section contains 4 questions. Each question contains statements given in two columns which have to be matched. Statements in Column 1 are labelled as (A), (B), (C) & (D) whereas statements in Column 2 are labeled as p, q, r, s & t. The answers to these questions have to be appropriately bubbled. More than one choice from Column 2 can be matched with Column 1.

1. MATCH THE FOLLOWING:

	Column 1		Column 2
(A)	XeF_2	**(p)**	Central atom has sp^2 hybridisation and molecule has bent geometry.
(B)	N_3^-	**(q)**	Central atom has sp^3d^2 hybridisation and molecule is non-polar.
(C)	PCl_6^-	**(r)**	Central atom has sp hybridisation and molecule has linear geometry
(D)	SO_2	**(s)**	Central atom has sp^3d hybridisation and molecule has zero dipole moment

2. MATCH THE FOLLOWING:

	Column 1		Column 2
(A)	Borax	**(p)**	$B_3N_3H_6$
(B)	Borazine	**(q)**	B_2H_6
(C)	Diborane	**(r)**	$Na_2B_4O_7.10H_2O$
(D)	Shows $p\pi - p\pi$ back bonding	**(s)**	BF_3

3. MATCH THE FOLLOWING:

	Column 1		Column 2
(A)	Two heavy hydrogen atom and one oxygen atom	**(p)**	Protium
(B)	1 proton, 1 electron, zero neutron	**(q)**	Deuterium
(C)	1 proton, 1 electron, 1 neutron	**(r)**	Tritium
(D)	1 proton, 1 electron, 2 neutron	**(s)**	Heavy water

4. Consider the following Column-1 and Column -2.

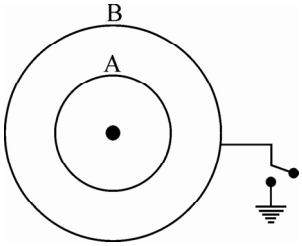
	Column 1		Column 2
(A)	ICl_4^-	**(p)**	Tetrahedral
(B)	SCl_4	**(q)**	Sea-Saw
(C)	ICl_3	**(r)**	T-shape
(D)	BCl_4^-	**(s)**	Square planar

SUBJECT - II (PHYSICS)	102 MARKS

SECTION-I
MULTIPLE CORRECT ANSWERS

This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct :

1. Two concentric shells *A* and *B* have radius *R* and 2*R*. charges q_A and q_B and potential 2*V* and 3*V*/2 respectively . Now the shell B is earthed and new charges on them become q_A and q_B respectively. Then :

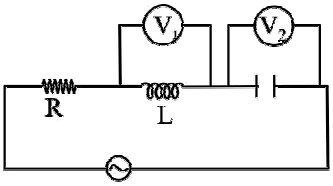


(A) $\frac{q_A}{q_B}=\frac{1}{2}$ **(B)** $\frac{q_A^{'}}{q_B^{'}}=1$

(C) Potential difference between *A* and *B* after earthing becomes 3V/2

(D) Potential difference between *A* and *B* after earthing becomes V/2

2. In figure shown $R=100\Omega$, $L=\frac{2}{\pi}H$ and $C=\frac{8}{\pi}\mu F$ are connected in series with an ac source of 200 *V* and frequency *f*. V_1 and V_2 are two hot-wire voltmeters. If the readings of V_1 and V_2 are same, then :



(A) $f=125\,Hz$ **(B)** $f=250\,p\,Hz$

(C) Current through R is 2A **(D)** $V_1=V_2=1000V$

3. Ball *A* of mass m moving with velocity *V* collides head on with a stationary ball *B* of mass *m*. If e be the coefficient of restitution, then which of the following statements are correct ?

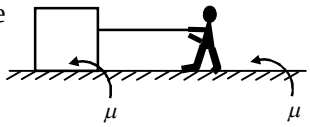
(A) The ratio of velocities of balls A and B after the collision is $\left(\frac{1+e}{1-e}\right)$

(B) The ratio of the final and initial velocities of ball A is $\left(\frac{1-e}{2}\right)$

(C) The ratio of the velocities of balls A and B after the collision is $\left(\frac{1-e}{1+e}\right)$

(D) The ratio of the final and initial velocities of ball B is $\left(\frac{1+e}{2}\right)$

4. A man pulls a block heavier than himself with a light rope as shown in the figure. The coefficient of friction is same between the man and the ground as well as that between the block and the ground.



(A) The block will not move unless the man also moves

(B) The man can move even when the block is stationary

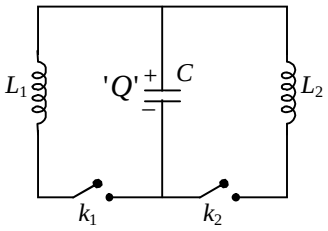
(C) If both move, the acceleration of the man is greater than the acceleration of the block

(D) None of the above assertions is correct

5. If the first minima in a Young's Double Slit Experiment occurs directly in front of one of the slits, (distance between plane of slits and screen *D* = 12 *cm* and distance between slits *d* = 5 *cm*) then the wavelength of the radiation used can be :

(A) 2 *cm* **(B)** 4 *cm* **(C)** $\frac{2}{3}$ *cm* **(D)** $\frac{4}{3}$ *cm*

6. The given arrangement carries a capacitor with capacitance 40mF and two inductors $L_1 = 25H$ and $L_2 = 100H$. If the capacitor initially carries a charge of 10 mC, then :



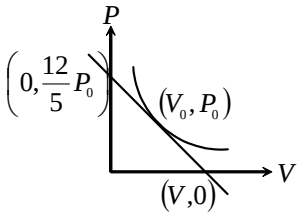
(A) the maximum current through the inductor L_1 when key k_1 is closed is 20 mA

(B) the maximum current through the inductor L_2 when key k_2 is closed is 5 mA

(C) the maximum current through inductor L_2 when both the keys are closed is $\sqrt{5}$ mA

(D) time period of oscillation of charge is minimum when both the keys are closed

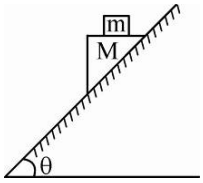
7. An ideal gas undergoes an adiabatic process. A tangent is drawn to the P-V graph of the gas at point (V_0, P_0) as shown in figure. Then :



(A) The gas is monoatomic **(B)** The gas is diatomic

(C) $V = 2V_0$ **(D)** $V = \frac{12}{7}V_0$

8. A wedge of mass M and a block of mass m are kept on an incline of inclination θ. The system is released from rest. The surface of the wedge on which the block rests is horizontal. all the surfaces are smooth then :



(A) The acceleration of the block is along the incline

(B) The acceleration of the block is in vertical direction

(C) The acceleration of the wedge is greater than g $\sin\theta$

(D) Normal force exerted by inclined plane on wedge is less than $(M + m)$ g $\cos\theta$

9. A point travelling along a straight line, traversed 1/3 of the distance with velocity v_0. The remaining part of the distance was covered with velocity v_1 for half time and the velocity v_2 for the other half of the time. Then the mean velocity of the point averaged over the whole time of motion :

(A) $\frac{v_0^2 + (v_1 - v_2)^2}{v_1 + v_2 + 2v_0}$ **(B)** $\frac{v_0^2 + (v_1 + v_2)^2}{v_1 + v_2 + v_0}$ **(C)** $\frac{3v_0(v_1 + v_2)}{v_1 + v_2 + v_0}$ **(D)** $\frac{3v_0(v_1 + v_2)}{v_1 + v_2 + 4v_0}$

10. A monkey of mass 40 *kg* climbs on a massless rope of breaking strength 600 *N*. The rope will not break if the monkey.

(A) Climbs up with a uniform speed 5 *m/s* **(B)** Climbs up with an acceleration 6 m/s^2

(C) Climbs down with an acceleration 4m/s^2 **(D)** Climbs down with a uniform speed 5 *m/s*

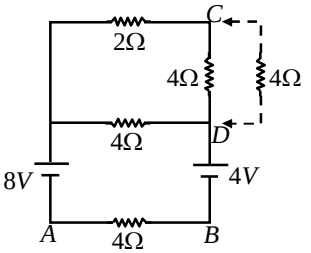
SECTION - II
SINGLE INTEGER VALUE CORRECT TYPE

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.

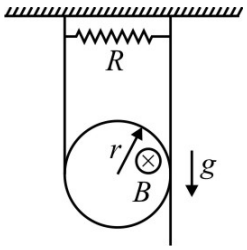
1. A cubical block of copper of side 10 *cm* is floating in a vessel containing mercury. Water is poured into the vessel so that the copper block just gets submerged. The height of water column (in *cm*) is _____.

2. A stationary observer receives sound waves from two tunings forks, one of which approaches and the other recedes with the same velocity. As this takes place, the observer hears beats with frequency 2 *Hz*. If the velocity of each tuning fork is k m/s^2 then the value of 10k is _____: (Their oscillation frequency is $v_0 = 680\,Hz$ and the velocity of sound in air is $V = 340\,m/s$, assume velocities of tuning forks << velocity of Sound)

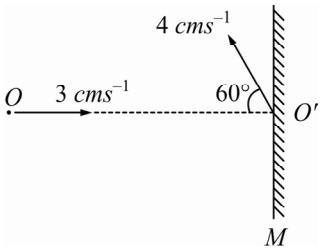
3. The change in current through branch *AB*, of the given circuit if a 4Ω resistance is connected to the existing 4Ω resistance (in *CD*) is $\left(\frac{x}{48}\right)A$, find the value of *x*.



4. A conducting light string is wound on the rim of a conducting ring (resistance = 0) of radius *r* and mass *m*. Free end of string is connected to ceiling. A vertical large conducting smooth plane is always tangent to the ring. The ring is released in a uniform magnetic field *B*. String and plane are connected to each other by resistance *R* as shown. The terminal velocity attained by centre of ring is $\frac{mgR}{nB^2r^2}$. Find *n*.

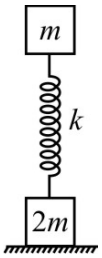


5. A point object *O* and a mirror *M* move with velocities of $3 cms^{-1}$ and $4 cms^{-1}$, respectively, as shown. OO' is the normal to the mirror. The magnitude of velocity of the image is _____.



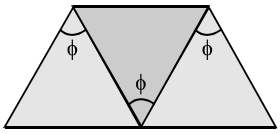
6. A plano-convex lens has a thickness of 4 *cm*. When placed on a horizontal table, with the curved surface in contact with it, the apparent depth of the bottom most point of the lens is found to be 3 *cm*. If the lens is inverted such that the plane face is in contact with the table, the apparent depth of the centre of the plane face is found to be (25/8) *cm*. The focal length of a lens is 25*n*. Then the value of *n* will be _____.

7. The minimum compression in the spring from its natural length so that the block of mass 2*m* leaves contact with the surface is $(n+1)\frac{mg}{k}$. where *n* is _____.



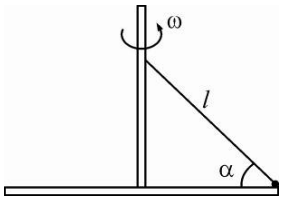
8. A radioactive sample contains two radio nucleoids A and B having decay constant λ hr^{-1} and 2λ hr^{-1}. Initially 25% of total decay comes from A. How long (in hr) will it take before 75% of total decay comes from A. [Take $\lambda = l\text{n } 3$]

9. A direct-vision prism is made out of three prisms, each with a refracting angle of 60^o, attached to each other as shown in the figure. Light of a certain wavelength is incident on the first prism. The angle of incidence is 30^o and the ray leaves the third prism parallel to the direction of incidence.



The refractive index of the glass of the first and third prisms is 1.5. Find the refractive index of the material of the middle prism. ($\sqrt{6}$ = 2.45). Round off your answer to the nearest integer.

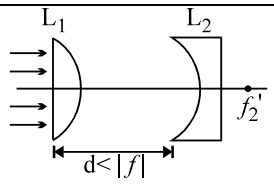
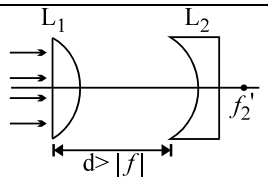
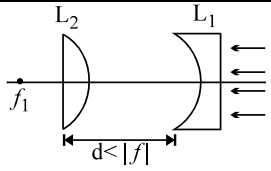
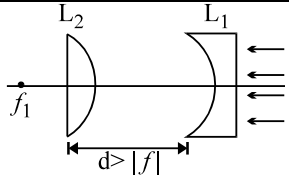
10. A circular platform rotates around a vertical axis with angular velocity $\omega = 10\,rad/sec$. On the platform is a ball of mass 1 *kg*, attached to the long axis of the platform by a thin rod of length 10 cm ($\alpha = 30°$). Find normal force exerted by the ball on the platform (in Newton). Friction is absent.



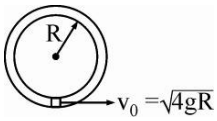
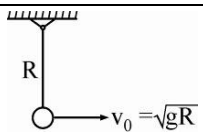
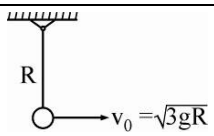
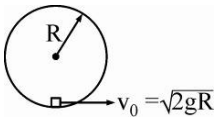
SECTION - III
MATRIX MATCH TYPE

This section contains 4 questions. Each question contains statements given in two columns which have to be matched. Statements in Column 1 are labelled as (A), (B), (C) & (D) whereas statements in Column 2 are labeled as p, q, r, s & t. The answers to these questions have to be appropriately bubbled. More than one choice from Column 2 can be matched with Column 1.

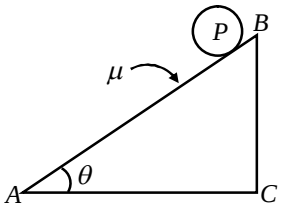
1. A glass disk whose plane surfaces are parallel is cut in two parts as shown in figure then the lenses so obtained are moved apart. What will happen to a beam of parallel rays falling on to the system. **(*f* is the focal length of converging lens)**

	Column 1		Column 2
(A)		**(p)**	Emerging rays are converging & image distance from $L_2 < f$
(B)		**(q)**	Emerging rays are diverging & image distance from $L_2 < f$
(C)		**(r)**	Emerging rays are converging & image distance from $L_2 > f$
(D)		**(s)**	Emerging rays are diverging & image distance from $L_2 > f$

2. **Column 1** shows constrained motion of a particle in vertical plane. Match the situations shown in **Column 1** with that the maximum height gained by the particles in **Column 2**.

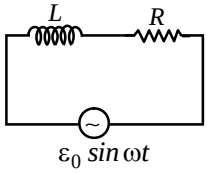
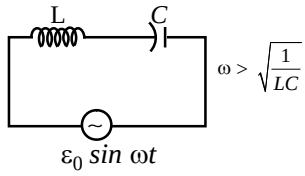
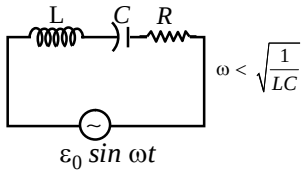
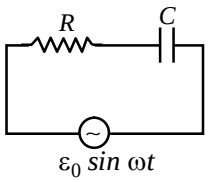
	Column 1 (Situations)		Column 2 (Maximum Height)
(A)	 A particle is projected inside a smooth tube, it fits slightly loosely inside it.	**(p)**	R/2
(B)	 A particle constrained on string.	**(q)**	2R
(C)	 A particle constrained on a massless rod	**(r)**	R
(D)	 A particle is projected inside a smooth spherical ball along the inner surface.	**(s)**	$\frac{3R}{2}$

3. A body P is rolling without slipping on the rough inclined surface as shown in the figure. The frictional force acting on the body is listed in List 2. Match the following columns:



	Column 1		Column 2
(A)	For ring	**(p)**	$mg\ \sin\theta(2/5)$
(B)	For solid sphere	**(q)**	$\frac{mg\ \sin\theta}{3}$
(C)	For solid cylinder	**(r)**	$(2/7)mg\ \sin\theta$
(D)	For hollow sphere	**(s)**	$(mg\ \sin\theta)/2$

4. MATH THE FOLLOWING :

	Column 1		Column 2
(A)		**(p)**	$\lvert\cos\phi\rvert = 1$, (ϕ is the phase difference between current and *emf*)
(B)		**(q)**	Current leads the *emf*
(C)		**(r)**	Current lags the *emf*
(D)		**(s)**	Average power dissipated is zero

SUBJECT - III (MATHEMATICS)	102 MARKS

SECTION-I

MULTIPLE CORRECT ANSWERS

This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct :

1. The equation of the plane which is equally inclined to the lines $\frac{x-1}{2}=\frac{y}{-2}=\frac{z+2}{-1}$ and $\frac{x+3}{8}=\frac{y-4}{1}=\frac{z}{-4}$ and passing through the origin is(are) :

(A) $14x-5y-7z=0$ **(B)** $2x+7y-z=0$

(C) $3x-4y-z=0$ **(D)** $x+2y-5z=0$

2. If A and B are two events such that $P(A)=\frac{3}{4}$ and $P(B)=\frac{5}{8}$ then :

(A) $P(A\cup B)\geq\frac{3}{4}$ **(B)** $P(A'\cap B)\leq\frac{1}{4}$

(C) $\frac{3}{8}\leq P(A\cap B)\leq\frac{5}{8}$ **(D)** $\frac{1}{8}\leq P(A\cap B')\leq\frac{3}{8}$

3. Consider the circle $x^2 + y^2 - 10x - 6y + 30 = 0$. Let O be the centre of the circle and tangent at A(7, 3) and B(5, 1) meet at C. Let S = 0 represents family of circles passing through A and B, then :

(A) Area of quadrilateral OACB = 4

(B) The radical axis for the family of circles S = 0 is $x + y = 10$

(C) The smaller possible circle of the family S = 0 is $x^2 + y^2 - 12x - 4y + 38 = 0$

(D) The coordinates of point C and (7, 1)

4. If $\int \frac{xe^{2x}}{\sqrt{1+e^{2x}}}dx = f(x)\sqrt{1+e^{2x}} - \frac{1}{2}\log g(x) + C$, then :

(A) $f(x) = x - 1$ **(B)** $g(x) = \frac{\sqrt{1+e^{2x}} - 1}{\sqrt{1+e^{2x}} + 1}$

(C) $g(x) = \frac{2 + e^{2x} - 2\sqrt{1+e^{2x}}}{e^{2x}}$ **(D)** $f(x) = x$

5. Tangents are drawn from the origin to the curve $y = \sin 2x$. The point of contact lies on :

(A) $y^2 = 4x^2(1 - y^2)$ **(B)** $x^2 - y^2 - x^2y^2 = 0$

(C) $x^2 + y^2 = 2x^2y^2$ **(D)** $\frac{1}{1-y^2} = \sec^2 2x$

6. If $f(x) = ae^{2x} + be^x + cx$ satisfies the conditions $f(0) = -1$, $f'(\log 2) = 31$, $\int_0^{\log 4}(f(x) - cx)dx = \frac{39}{2}$, then :

(A) $a = 5$ **(B)** $b = -6$ **(C)** $c = 2$ **(D)** $a = 3$

7. If $I = \int_0^{\pi/2} e^{-\alpha \sin x}\, dx$, where $\alpha \in (0, \infty)$, then :

(A) $I < \frac{\pi}{2}$ **(B)** $I > \frac{\pi}{2}(e^{-\alpha} + 1)$ **(C)** $I > \frac{\pi}{2}e^{-\alpha}$ **(D)** $I > 0$

8. If α, β are the roots of the equation $\lambda(x^2 - x) + x + 5 = 0$. If λ_1 and λ_2 are two values of λ for which the roots α, β are related by $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{4}{5}$, then the value of $\frac{\lambda_1}{\lambda_2} + \frac{\lambda_2}{\lambda_1} + 4$ is divisible by :

(A) 2 **(B)** 6 **(C)** 3 **(D)** 4

9. If $\tan\theta_i$; $i = 1, 2, 3, 4$ are the roots of equation $x^4 - x^3 \sin 2\beta + x^2 \cos 2\beta - x\cos\beta - \sin\beta = 0$, then $\tan(\theta_1 + \theta_2 + \theta_3 + \theta_4)$ is equal to :

(A) $\frac{1 - \cos 2\beta}{\sin 2\beta}$ **(B)** $\frac{1 + \cos 2\beta}{\sin 2\beta}$ **(C)** $\tan\beta$ **(D)** $\cot\beta$

10. If ${}^nC_{r-1} = (k^2 - 8)({}^{n+1}C_r)$, then k belongs to :

(A) $[-3, -2\sqrt{2})$ **(B)** $(-3, 3)$ **(C)** $(2\sqrt{2}, 3]$ **(D)** $[-2\sqrt{2}, 2\sqrt{2}]$

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 $\alpha, \beta\ ;\ \beta, \gamma\ ;\ \gamma, \alpha$ are the roots of $a_r x^2 + b_r x + c_r = 0$ for $r = 1, 2, 3$ where $\alpha, \beta, \gamma > 0$ and $\sum\alpha + \sum\alpha\beta + \alpha\beta\gamma = \left(\prod_{r=1}^{3}\left(\frac{a_r - b_r + c_r}{a_r}\right)\right)^{1/2} - k$ then k is equal to _____.

2. Let $A_1 = \int_{n}^{n+1}\left(min\left\{|x-n|, |x-(n+1)|\right\}\right)dx$, $A_2 = \int_{n+1}^{n+2}\left(|x-n| - |x-(n+1)|\right)dx$,

$A_3 = \int_{n+2}^{n+3}|x-(n+4)| - |x-(n+3)|\,dx$

Then the value of $[A_1 + A_2 + A_3]$ is _____. [where [.] denotes the greatest integer function]

3. All the face cards are removed from a pack of 52 cards. From the remaining cards half of the cards are removed without looking at them. Now if the probability of 2 cards drawn from remaining half of cards without replacement is $\frac{\alpha\ .\ {}^{\beta}C_{20}}{{}^{\gamma}C_{20}\ .\ {}^{20}C_{\delta}}$, then last digit of $\beta^{\alpha} + \delta^{\gamma}$ is _____.

4. If $a_1, a_2, a_3, 5, 4, a_6, a_7, a_8, a_9$ are in HP, then the value of determinant $\begin{vmatrix} a_1 & a_2 & a_3 \\ 5 & 4 & a_6 \\ a_7 & a_8 & a_9 \end{vmatrix}$ can be expressed in the lowest form as p/q, then the value of $(p - 2q)$ is _____.

5. From a point on the line $y = x + c$, tangents are drawn to the hyperbola $\frac{x^2}{2} - \frac{y^2}{1} = 1$ such that chords of contact pass through a fixed point (x_1, y_1). Then, x_1/y_1 is equal to _____.

6. If the minimum distance between $y - x = 2$ and $y^2 = 4x$ is 'd' then the value of $2\sqrt{2}d$.

7. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three non-zero and non-coplanar vectors and $\vec{p}, \vec{q}$ and $\vec{r}$ be three vectors given by :

$\vec{p} = \vec{a} + 3\vec{b} - 2\vec{c}$, $\vec{q} = 3\vec{a} - 2\vec{b} + \vec{c}$ and $\vec{r} = \vec{a} - 4\vec{b} + 2\vec{c}$.

If the volume of the parallelepiped determined by $\vec{a}, \vec{b}$ and $\vec{c}$ is V_1 and that of the parallelepiped determined by $\vec{p}, \vec{q}, \vec{r}$ is V_2, then $V_2 : V_1$ is equal to _____.

8. Let $f(x)$ be a polynomial of degree six divisible by x^3, and having a point of extrema at $x = 2$. If $f'(x)$ is divisible by $1 + x^2$, then the value of $\frac{3f(2)}{2f(1)}$ is equal to _____.

9. If x_1, x_2, x_3 are such that : $x_1 + x_2 + x_3 = 2$, $x_1^2 + x_2^2 + x_3^2 = 6$, $x_1^3 + x_2^3 + x_3^3 = 8$, then the value of $-(x_2 - x_3)(x_3 - x_1)(x_1 - x_2)$ is equal to _____.

10. If $f(x)$ be a twice differentiable function from $R \to R$ such that $t^2 f(x) - 2tf'(x) + f''(x) = 0$ has two equal values of t for all x and $f(0) = 1, f'(0) = 2$. The value of $\left(\lim_{x\to 0}\frac{f(x)-1}{x} - \frac{t}{2}\right)$ is equal to _____.

SECTION - III

MATRIX MATCH TYPE

This section contains 4 questions. Each question contains statements given in two columns which have to be matched. Statements in Column 1 are labelled as (A), (B), (C) & (D) whereas statements in Column 2 are labeled as p, q, r, s & t. The answers to these questions have to be appropriately bubbled. More than one choice from Column 2 can be matched with Column 1.

1. MATCH THE FOLLOWING :

	Column 1		Column 2
(A)	$\begin{vmatrix} 1 & \cos\alpha & \cos\beta \\ \cos\alpha & 1 & \cos\gamma \\ \cos\beta & \cos\gamma & 1 \end{vmatrix} = \begin{vmatrix} 0 & \cos\alpha & \cos\beta \\ \cos\alpha & 0 & \cos\gamma \\ \cos\beta & \cos\gamma & 0 \end{vmatrix}$ if $\cos^2\alpha + \cos^2\beta + \cos^2\gamma =$	**(p)**	26
(B)	The value of $\left(\vec{a} \times \vec{b}\right).\left(\vec{c} \times \vec{d}\right) + \left(\vec{b} \times \vec{c}\right).\left(\vec{a} \times \vec{d}\right) + \left(\vec{c} \times \vec{a}\right).\left(\vec{b} \times \vec{d}\right)$	**(q)**	$\frac{1}{3}$
(C)	If plane $2x+3y+6z+k=0$ is tangent to the sphere $x^2+y^2+z^2+2x-2y+2z-6=0$, then a value of k is	**(r)**	0
(D)	There are four boxes A_1, A_2, A_3 and A_4. Box A_i has i cards and on each card a number is printed, the numbers are from 1 to i. A box is selected randomly, the probability of selection of box i, is $i/10$ and then a card is drawn. Let E_i represents the event that a card with number 'i' is drawn. $P(A_3/E_2)$ is equal to	**(s)**	1

2. MATCH THE FOLLOWING :

	Column 1		Column 2
(A)	The sum of abscissa and ordinate of the point on the parabola $y=x^2+7x+2$ which is nearest to the straight line $y=3x-3$ is equal to	**(p)**	1
(B)	If a circle is drawn with variable chord $x+ay-5=0$ ('a' being a parameter) of the parabola $y^2=20x$ as diameter, then it always touches the line $x+k=0$, where k is equal to	**(q)**	-10
(C)	The foot of perpendicular from a point P on the parabola to its directrix is M. If R is the mid-point of SM $(S \equiv \text{focus})$, then the angle between PR and SM is equal to $\frac{\pi k}{2}$, where k is equal to	**(r)**	5
(D)	If the normals at the end points of a variable chord AB of the parabola $y^2-4y-2x=0$ are perpendicular, then the tangents at A and B will intersect at the line $2x+k=0$, where k is equal to	**(s)**	-5

3. Match the maximum or minimum value of the function in **Column 1** with corresponding the values in **Column 2.**

Column 1		Column 2	
(A)	The greatest value of $f(x)=\frac{x}{4+x+x^2}$ on $[0,\infty)$ is	**(p)**	$\frac{18}{e}$
(B)	The maximum value of $\frac{\ln x}{x}$ in $[2,\infty)$ is	**(q)**	$\frac{1}{e}$
(C)	Let $x>0, y>0$ and $xy=1$, then minimum value of $\frac{3}{e^3}x+27ey$	**(r)**	e
(D)	The perimeter of a sector is $4e$. The area of the sector is maximum when its radius is	**(s)**	$\frac{1}{5}$
		(t)	An irrational number

4. **MATCH THE FOLLOWING :**

	Column I		Column II
(A)	If $f(x)=\int_0^{g(x)}\frac{dt}{\sqrt{1+t^3}}$, where $g(x)=\int_0^{\cos x}\left(1+\sin t^2\right)dt$ then the value of $f'(\pi/2)$ is equal to	**(p)**	-2
(B)	If $f(x)$ is a non-zero differentiable function such that $\int_0^x f(t)\,dt=\{f(x)\}^2$ for all x, then $f(2)$ equals	**(q)**	2
(C)	If $\int_a^b\left(2+x-x^2\right)dx$ is maximum, then $(a+b)$ is equal to	**(r)**	1
(D)	If $\lim_{x\to 0}\left(\frac{\sin 2x}{x^3}+a+\frac{b}{x^2}\right)=0$, then $(3a+b)$ has the value	**(s)**	-1