IIT-JEE (2006)
(Memory Based Question Paper)
PHYSICS

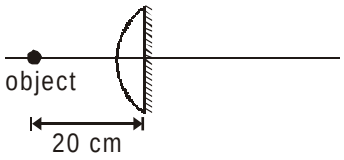
Section I: Multiple Choice Questions with one correct answer.

Q.1 A student performs experiment to determine g using formula $g = \frac{4\pi^2 \ell}{T^2}$; here ℓ (length of the wire) is approximately equal to 1m, $\Delta\ell$ represents error in measurement of length ℓ, ΔT represents error in measurement of time, n is total number of oscillation. Then for which of the data of the measurement of g will be most accurate ?

	$\Delta\ell$	ΔT	n	Amplitude of oscillation
(a)	5 mm	0.2sec	10	5mm
(b)	5 mm	0.2 sec	20	5mm
(c)	5 mm	0.1 sec	20	1 mm
(d)	1 mm	0.1 sec	50	1mm

Ans. (d)

Q.2 Focal length of the shown plano-convex lens is 15 cm. Plane surface of the lens is silvered. An object is kept on the principal axis of the lens at a distance 20 cm. Image of the object will form.



(a) 60 cm, left (b) 60 cm, right
(c) 12 cm, left (d) 30 cm, right

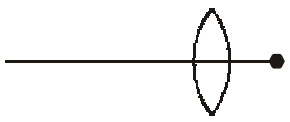
Ans. (c)

Q.3 Half life of a radioactive sample is 4 days. Find the probability that a particular nucleus of the radioactive material decays after 2 half life is

(a) 1 (b) $\frac{1}{2}$ (c) $\frac{3}{2}$ (d) $\frac{3}{4}$

Ans. (d)

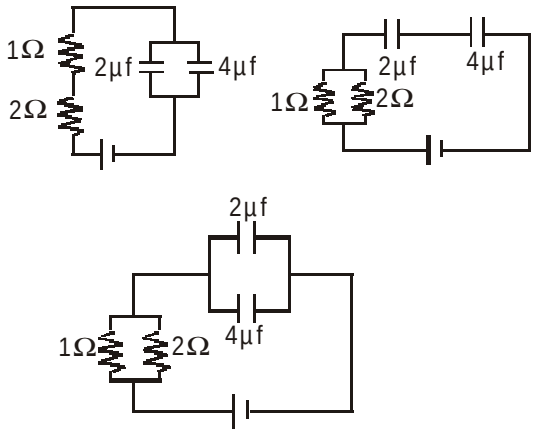
Q.4 The image of sun is formed on focal plane of lens which is a circular in shape of radius r and area πr^2.



(a) $\pi r^2 \propto f$
(b) $\pi r^2 \propto f^2$
(c) lens is covered half so half image is formed
(d) on increasing focal length, brightness of the image increases

Ans. (b)

Q.5 Time constant for the given circuits are.

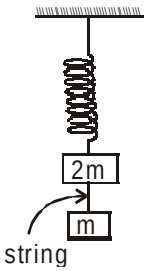


(a) 18 μs, $\frac{8}{9}$ μs, 4 μs (b) 18 μs, 4 μs, $\frac{8}{9}$ μs

(c) 4 μs. $\frac{8}{9}$ μs, 18 μs (d) $\frac{8}{9}$ μs, 18 μs, 4 μs

Ans. (a)

Q.6 In the system shown if the inextensible string connecting 2m and m is cut, the accelerations of mass m and 2m are

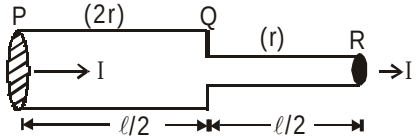


(a) $\frac{g}{2}, \frac{g}{2}$ (b) g, $\frac{g}{2}$

(c) $\frac{g}{2}$, g (d) g, g

Ans. (b)

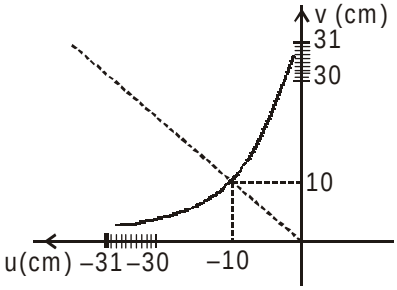
Q.7 In the figure shown length of each wire is $\ell/2$ and their radii are 2r and r. Then



(a) current density in both wires is same
(b) power dissipated in QR is 4 times that in the PQ
(c) ratio of potential drops on PQ & QR is 4
(d) resistance of PQ is 4 times that of QR

Ans. (b)

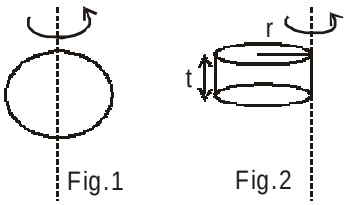
Q.8 Graph of position of image vs position of a point object from a convex lens is shown in the figure. Then focal length of the lens is



(a) (0.50 ± 0.05) cm
(b) (0.50 ± 0.10) cm
(c) (5.00 ± 0..05) cm
(d) (5.00 ± 0.10) cm

Ans. (c)

Q.9 Moment of inertia of solid sphere of mass m and radius R about axis passing through center of mass is I as shown in figure 1. The sphere is moulded in the form of disc of radius 'r' and thickness 't'. The moment of inertia of disc about the axis shown in figure 2 is I.



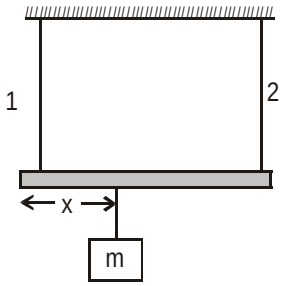
The radius of disc is

(a) $\frac{2R}{\sqrt{15}}$ (b) $\frac{2R}{\sqrt{5}}$

(c) $\frac{R}{\sqrt{15}}$ (d) $\frac{R}{\sqrt{5}}$

Ans. (a)

Q.10 Wire 1 is vibrating in first harmonic: Wire 2 is vibrating in second harmonic : What is the position x of mass m



(a) $\frac{4L}{5}$ (b) $\frac{L}{5}$

(c) $\frac{L}{4}$ (d) $\frac{3L}{4}$

Ans. (b)

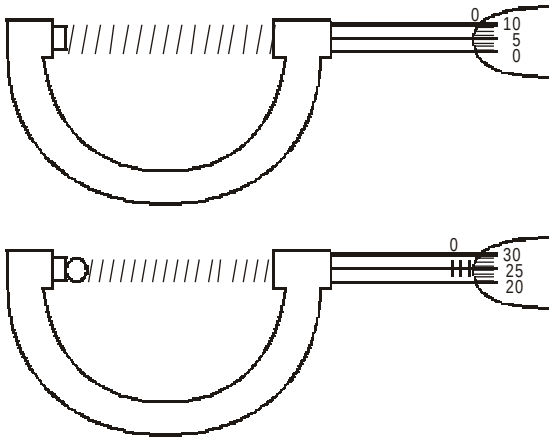
Q.11 A double star system having two stars of masses m_1 and m_2, is rotating about common center of mass in radius r_1 and r_2, with periods T_1 and T_2, then

(a) $\left(\frac{T_1}{T_2}\right)=\left(\frac{r_1}{r_2}\right)^3$

(b) if $T_1 > T_2$ then $R_1 > R_2$
(c) if $T_1 > T_2$ then $m_1 > m_2$
(d) $T_1 = T_2$

Ans. (d)

Q.12 The circular divisions of shown screw gauge are 50 It moves 0.5 mm on main scale in one rotation. The diameter of the ball is -

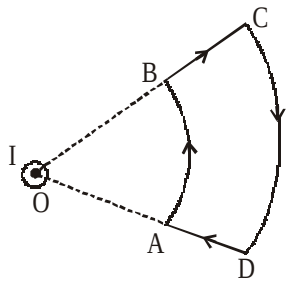


(a) 2.25 mm (b) 2.20 mm
(c) 1.20 mm (d) 1.25 mm

Ans. (c)

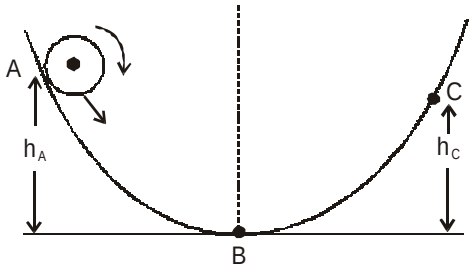
Section II: Multiple Choice Questions with one or more correct answer(s).

Q.13 An infinite wire carrying current I passes through point O perpendicular to the plane containing a current carrying loop ABCD as shown in the figure.



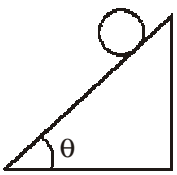
(a) Net force on the loop is zero
(b) Net torque on the loop is zero
(c) The loop rotates in anticlockwise direction as seen from O
(d) The loop rotates in clockwise direction as seen from O **Ans. (a, d)**

Q.14 A ball is rolling on the track as shown in the figure. AB is rough surface and BC is smooth. Ball reaches to the height C. K_A, K_B and K_C are the kinetic energies at A, B and C.



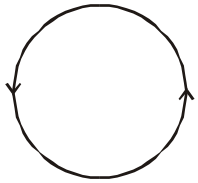
(a) $h_A > h_C$; $K_B > K_C$
(b) $h_A < h_C$; $K_B > K_C$
(c) $h_A = h_C$; $K_B = K_C$
(d) $h_A > h_C$; $K_A < K_C$ **Ans. (a, d)**

Q.15 A solid cylinder is rolling over an inclined plane as shown in the figure.



(a) friction force is dissipative
(b) on decreasing θ, frictional force decreases
(c) friction force does help in rotation and opposes translation
(d) friction force is necessarily μmgcosθ
Ans. (b, c)

Q.16 The given figure shows lines of force of a particular field. Out of the following option, the field line can not represent.



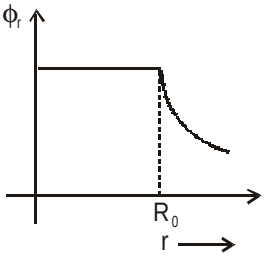
(a) An electrostatic field
(b) A magneto static field
(c) A gravitational field
(d) An induced electric field
Ans. (a, c)

Q.17 The adjacent figure shows variation of electric potential with distance for a spherical symmetric charge distribution system and given as

$$\phi_r = \frac{q}{4\pi\varepsilon_0 r} \quad (r \geq R_0)$$

$$\phi_r = \frac{q}{4\pi\varepsilon_0 R_0} \quad (r \leq R_0)$$

Which of the following option is/are correct ?



(a) For spherical region $r \leq R_0$ total electrostatic energy stored is zero
(b) Within $r = 2R_0$, total charge is q.
(c) There will be no charge anywhere except at $r = R_0$
(d) Electric field is discontinuous at $r = R_0$
Ans. (a, b, c, d)

Q.18 $f(t) = A\sin^2\omega t + B\cos^2\omega t + C\sin\omega t\cos\omega t$

The above function represents SHM

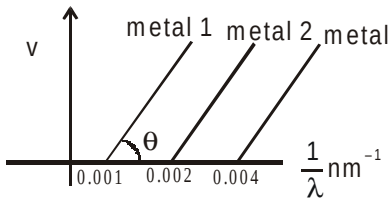
(a) for all values of A and B, with $C \neq 0$

(b) $A = -B$, $C = 2B$; with amplitude $\sqrt{2}$ B

(c) $A = B$, $C = 2B$; amplitude $|B|$

(d) $A = B$, $C = 0$ **Ans. (b, c)**

Q.19 The graph between $\frac{1}{\lambda}$ and stopping potential (V) of three metal having work functions ϕ_1, ϕ_2 and ϕ_3 in an experiment of photo electric effect is plotted as shown in the figure which of the following statement(s) is/are correct ? (λ represents wavelength of the incident ray.)



(a) Ratio of work functions $\phi_1 : \phi_2 : \phi_3 = 1 : 2 : 4$

(b) Ratio of work functions $\phi_1 : \phi_2 : \phi_3 = 4 : 2 : 1$

(c) $\tan\theta$ is directly proportional to hc/e, where h is plank's constant and c is the speed of light

(d) the violet color can eject photoelectrons from metal 2 & 3. **Ans. (a, c)**

Q.20 A black body at temperature T is kept in a dark room with surrounding temperature T_0. Sun rays are allowed to fall on the black body through a hole in the roof of the room while T and T_0 are maintained. Assuming that there is no change in the surrounding temperature of the room, select the correct statement(s).

(a) The quantity of radiation absorbed by the black body per unit time will increase

(b) The quantity of radiation emitted by black body per unit time will increase

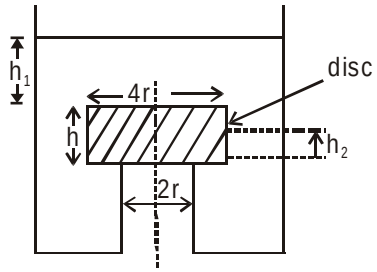
(c) Black body radiates more energy per unit time in the visible spectrum

(d) The reflected energy per unit time by the black body remains same **Ans. (d)**

Section III:Questions based on comprehensions with one correct answer.

PASSAGE - 1

A tank has a cylindrical opening as shown of diameter 2r. A cylinder of diameter 4r and density ρ/3 is placed on the top of the opening as shown in figure. Liquid of density ρ is to be filled in the tank.



Q.21 What is the height h_1 of the liquid level for the mass to be lifted.

(a) $h_1 = \frac{5h}{4}$ (b) $h_1 = \frac{5h}{3}$

(c) $h_1 = \frac{2h}{3}$ (d) $h_1 = \frac{5h}{2}$

Ans. (b)

Q.22 The disc is kept pressed and water is lowered in the tank upto the height 'h_2' as shown, what is the height h_2 for the disc to be again lifted.

(a) $\frac{h}{3}$ (b) $\frac{4h}{9}$

(c) $\frac{2h}{3}$ (d) h **Ans. (b)**

Q.23 Water is still lowered in the tank, what is the another height h'_2, for the disc to be lifted ?

(a) $\frac{h}{3}$ (b) $\frac{h}{4}$

(c) $\frac{h}{5}$

(d) no height h'_2 at which disc will be lifted

Ans. (d)

PASSAGE-2

Equations of two waves are given as

$y_1 = A\cos[0.5\pi x - 100\pi t)$

$y_2 = A\cos[0.46\pi x - 92\pi t)$

Q.24 How many maximum will a stationary observer hear ?

(a) 4 (b) 5

(c) 6 (d) 7

Ans. (a)

Q.25 Resultant wave is given as $y_R = y_1 + y_2$ at x = 0. How many times is the resultant y_R zero in 1 sec.

(a) 100 (b) 192
(c) 46 (d) 96

Ans. (d)

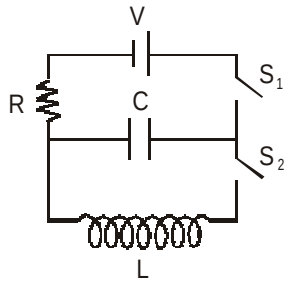
Q.26 Maximum velocity of the wave having maximum intensity.

(a) 200 m/s (b) 180 m/s
(c) 192 m/s (d) 100 m/s

Ans. (a)

PASSAGE-3

The capacitor of capacitance C can be charged (with the help of resistance R) by a battery of e.m.f. V while keeping switch S_2 open. The capacitor can be connected to an inductor of inductance L by closing switch S_2 and opening S_1.



Q.27 Initially the capacitor was uncharged, Now switch S_1 is closed and S_2 is kept open. If time constant of the given circuit is τ then

(a) After 1 time constant, charge on the capacitor is CV/2

(b) After time interval 2τ, charge on the capacitor is $CV(1 - e^{-2})$

(c) The work done by the voltage source will be half of the heat dissipated, when the capacitor is fully charged

(d) After 2 time constant, charge on the capacitor is $CV(1 - e^{-1})$

Ans. (b)

Q.28 After the capacitor gets fully charged, S_1 is opened, and S_2 is closed so that the inductor is connected in series with the capacitor, then

(a) at t = 0, energy stored in the circuit is purely in the form of magnetic energy

(b)direction of current is same for any time t

(c) at t > 0, there is no exchange of energy takes place between the inductor and capacitor

(d) maximum current in the circuit is $v\sqrt{\frac{C}{L}}$

Ans. (d)

Q.29 If maximum charge stored on the capacitor in LC circuit is Q_0 then for $t \geq 0$.

(a) the charge on the capacitor $Q = Q_0\cos\left(\frac{\pi}{2} - \frac{1}{\sqrt{LC}}t\right)$

(b) the charge on the capacitor is $Q = -LC\frac{d^2Q}{dt^2}$

(c) the charge on the capacitor is $Q = Q_0\cos\left(\frac{\pi}{2} + \frac{1}{\sqrt{LC}}t\right)$

(d) the charge on the capacitor is $Q = -\frac{1}{\sqrt{LC}}\frac{d^2Q}{dt^2}$

Ans. (b)

PASSAGE - 4

A number of designs have been developed for magnetic leviation. In one of the designs electrodynamic system (EDS) is used. This model is conceptually simple because it depends only on the attractive force between magnets and ferromagnetic materials. In Japan the magnetic levitated trains run based on the EDS model which uses Lenz's Law in the simplest form. The train carries a magnet. As the magnet passes over a metal plate or coils of wire currents are induced in the plates or coils that tend to oppose the original change this results in repulsive force which lifts the train. This model has a stabilizing feature that if the train drops the repulsion becomes stronger and pushes the train back up. If the train rises the fore decreases and the train drops down. In Maglev Train the dissipative forces against friction are absent. The disadvantage of this modal is that induced current results in drag force as well as lift force. This requires more power for propulsion The drag force is larger than the lift force for small speed, but the drag force maximizes at some speed and then begins to decrease. The lift force continues to increase as the speed increases. Thus it is advantageous to travel at high speed, but the significant drag force at low speed must be overcome as the train starts up.

Q.30 What causes the train to lift up -

(a) Electrostatic force

(b) Time varying electric field

(c) Magnetic force

(d) Induced electric field

Ans. (c)

Q.31 The limitation of E.D.S model is that

(a) The train experiences upward force due to Lenz's law.

(b) Friction force creates a drag on the train

(c) Retardation is caused

(d) By Lenz's law train experiences a drag force

Ans. (d)

Q.32 The advantage of the train is that -

(a) Electromagnetic force draws the train

(b) Gravitational force is zero

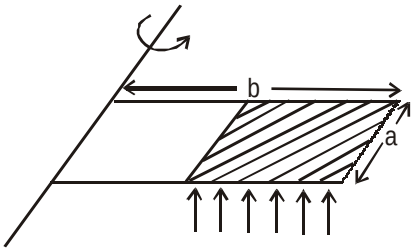
(c) Electrostatic force draws the train

(d) Resistive forces due to friction are absent

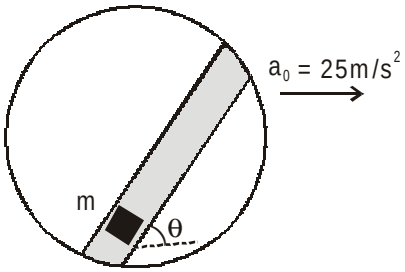
Ans. (d)

Section IV: This section consists of 4 questions. Answers are to be given in between 0000 to 9999 in the form of nearest integer.

Q.33 'n' balls per second per unit area of mass m collide elastically with plate of mass m on the half shaded region as shown. If the plate remains in equilibrium. Find the velocity of balls. (n = 100, m = 0.01 kg, M = 3kg, b = 2m, a = 2m g = 10 m/s2.) **Ans. 0010**



Q.34 A disc having a groove as shown in kept on smooth horizontal plane. A block of mass m can slide in the groove. The disc move with acceleration a_0 = 25 m/s2 as shown in figure. The coefficient of friction between block and groove is 2/5 and sinθ = 3/5. Find the acceleration of block relative to the disc.



Ans. 0010

Q.35 A thermally insulated container has 0.43 kg of ice at –20ºC. Steam at 373 K is passed through the ice. Find the final temperature of mixture. **Ans. 0273**

Q.36 In a hydrogen like atom (z = 11), n^{th} line of Lyman series has wavelength λ equal to the deBroglie's wavelength of electron in the level from which it originated, what is the initial energy level of electron. **Ans. 0025**

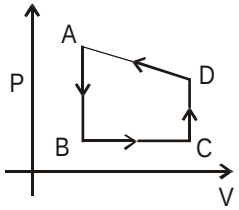
Section V: This section consists of 4 questions. Each having two columns with 4 entries in each column. Entries of column I are to be matched with column II. One entry of column I may have more than one matching in column II.

Q.37

Column-I	**Column-II**
(A) Nuclear Fusion	(P) Some matter converted into energy
(B) Nuclear Fission	(Q) Generally occurs in nuclei having low atomic number.
(C) β-decay	(R) Generally occurs in nuclei having higher atomic number.
(D) Exothermic reaction	(S) Essentially occurs due to weak nuclear force.

Ans. A → P, Q
B → P, R
C → P, S
D → P, Q, R

Q.38 ΔW-represents work done by the system and ΔQ represents heat absorbed by the system



Column I	**Column II**
(A) AB	(P) ΔW > 0
(B) BC	(Q) ΔW < 0
(C) CD	(R) ΔQ > 0
(D) DA	(S) ΔQ < 0

Ans. A → S
B → P, R
C → R
D → Q, S

Q.39

Column-I	**Column II**
(A) A stationary uniformly charged dielectric ring	(P) Time independent electrostatic field out of system
(B) Dielectric ring uniformly charged rotating with angular velocity ω.	(Q) Magnetic field
(C) Constant current in ring i_0	(R) Induced electric field
(D) $i = i_0 \cos\omega t$	(S) Magnetic moment

Ans. A → P
B → P, Q, S
C → Q, S
D → Q, R, S

Q.40 Focal length of objective & eyepiece of a telescope are f_O & fe respectively.

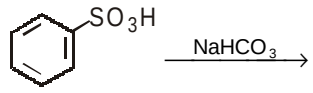
Column - I	**Column - II**
(A) Intensity of the image	(P) Radius of curvature (R)
(B) Angular magnification	(Q) Dispersion of lens
(C) Length of telescope	(R) Focal length f_O & f_e
(D) Sharpness of image	(S) Spherical aberration

Ans. A → P
B → R
C → R
D → P, Q, S

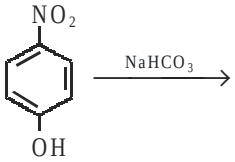
IIT–JEE (2006)
(Memory Based Question Paper)
CHEMISTRY

Section I : Multiple Choice Questions with one correct answer.

Q.1



(I)



(II)

Gases released in reaction (I) and (II) are :

(a) CO_2, CO_2 (b) SO_2, NO_2
(c) SO_2, CO_2 (d) SO_2, NO

Ans. (a)

Q.2 IUPAC name of $C_6H_5 - \overset{O}{\overset{\|}{C}} - Cl$

(a) Benzoylchloride
(b) Benzenecarbonylchloride
(C) Chlorophenyl ketone (d)
phenylchloroketone

Ans. (b)

Q.3 $CH_3 - CH = CH_2 \xrightarrow{NOCl}$ Product

Product is :

(a) $CH_3 - \underset{\underset{Cl}{|}}{CH} - CH_2 - NO$

(b) $CH_3 - \underset{\underset{NO}{|}}{CH} - CH_2 - Cl$

(c) $CH_3 - CH_2 - CH_2 - Cl$
(d) $NO - CH_2 - CH_2 - CH_2 - Cl$

Ans. (a)

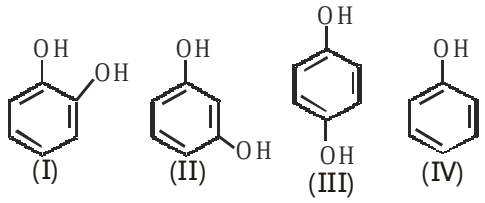
Q.4 $CH_3NH_2 + CHCl_3 \xrightarrow{KOH}$ Product,

Product is :

(a) $CH_3 - \overset{\oplus}{N} \equiv \overset{\ominus}{C}:$ (b) $CH_3 - \overset{\oplus}{\ddot{N}} \equiv \overset{}{C}:$
(c) $CH_3 - NH - CH_3$ (d) $CH_3 - C \equiv N$

Ans. (a)

Q.5 Order of boiling point for the following compounds is :



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

(a) (I) < (II) < (III) < (IV)
(b) (I) < (II) < (IV) < (III)
(c) (IV) < (I) < (II) < (III)
(d) (II) < (I) < (III) < (IV)

Ans. (c)

Q.6 On dilution with H_2O and after boiling results in the formation of white ppt. The formation of white gelatenous ppt. take place OH treating it with excess mixture of NH_4OH & NH_4Cl. Identify the ppt. which dissolves in NH_4OH/NH_4Cl :

(a) $Zn(OH)_2$ (b) $Al(OH)_3$
(c) $Ca(OH)_2$ (d) $Mg(OH)_2$

Ans. (a)

Q.7 Express molar specific heat in terms of R, given that P/ V at any instant is constant and is equal to 1.

(a) $\frac{3}{2}$ RT (b) $\frac{5}{2}$ RT

(c) $\frac{4}{2}$ RT (d) 0

Ans. (c)

Q.8 $B(OH)_3 + NaOH \rightleftharpoons NaBO_2 + Na[B(OH)_4] + H_2O$

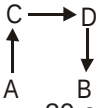
The reaction can be made to proceed in the forward direction by adding :

(a) cis 1,2 diol (b) borax

(c) trans 1, 2 diol (d) Na_2HPO_4

Ans. (a)

Q.9 The conversion A to B is carried out by the following path :



Given : $\Delta S_{(A \rightarrow C)} = 50$ e.u. , $\Delta S_{(C \rightarrow D)} = 30$ e.u. , $\Delta S_{(B \rightarrow D)} = 20$ e.u.

Where e.u. is entropy unit then $\Delta S_{(A \rightarrow B)}$ is :

(a) +100 e.u. (b) + 60 e.u.

(c) –100 e.u. (d) – 60 e.u.

Ans. (b)

Q.10 $CuSO_4$ decolorizes on addition of KCN the product is :

(a) $[Cu(CN)_4]^{2-}$

(b) Cu^{2+} get reduced to form $[Cu(CN)_4]^{3-}$

(c) CuCN

(d) $Cu(CN)_2$

Ans. (b)

Q.11 $Ag^+ + NH_3 \rightleftharpoons [Ag(NH_3)^+]$; $K_1 = 1.6 \times 10^3$

$[Ag(NH_3)]^+ + NH_3 \rightleftharpoons [Ag(NH_3)_2]^+$

$K_2 = 6.8 \times 10^3$

The formation constant of $[Ag(NH_3)_2]^+$ is

(a) 6.08×10^6 (b) 1.08×10^7

(c) 1.08×10^3 (d) 3.8×10^5

Ans. (b)

Q.12 In the Haber process which of the following is correct if the reaction is carried out in a vessel of constant volume

$N_2 + 3H_2 \rightleftharpoons 2NH_3$

(a) If N_2 is added the equilibrium will shift to right. Because according to II law of thermodynamics entropy must increase in the direction of spontaneous reaction.

(b) The condition for equilibrium is $G_{N_2} + 3G_{H_2} = 2G_{NH_3}$ where G is Gibbs free energy per mole of the gaseous species measured at that partial pressure. The condition of equilibrium is unaffected by the use of catalyst which increases the rate of both the forward reaction by α and that of backward reaction by β.

(c) The catalyst will increase the rate of forward reaction by α and that of backward reaction β.

(d) If the reaction is carried out at 400 K then forward rate constant remains unaffected while the backward rate constant is decreased.

Ans. (a)

Section II : Multiple Choice Questions with one or more correct answer(s).

Q.13 The bond length of CO is 1.128Å. The bond length of CO in $Fe(CO)_5$ is (in Armgostrons)

(a) 1.76 (b) 1.128

(c) 1.15 (d) 1.118

Ans. (d)

Q.14 $CH_3 - \overset{O}{\overset{\|}{C}} - CH_3$ + next homologue

$\xrightarrow{NH_2OH}$ mixture

Following statements is/are correct about mixture :

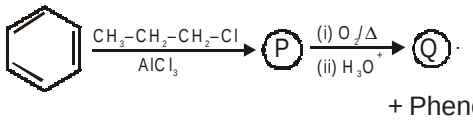
(a) mixture is 3-types of oximes

(b) mixture is 2-types of oximes

(c) all are optically active

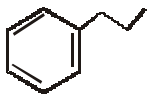
(d) one is optically active.

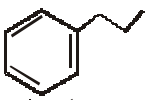
Ans. (a)

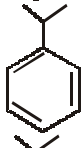
Q.15 

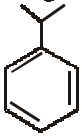
+ Phenol

P & Q are :

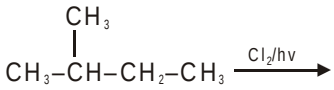
(a)  and $CH_3 - CH_2 - \overset{O}{\overset{\|}{C}} - H$

(b)  and $CH_3 - \overset{O}{\overset{\|}{C}} - CH_3$

(c)  and $CH_3 - \overset{O}{\overset{\|}{C}} - CH_3$

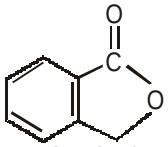
(d)  and $CH_3 - CH_2 - \overset{O}{\overset{\|}{C}} - H$

Ans. (c)

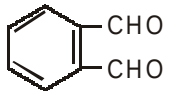
Q.16 

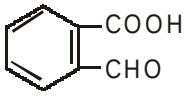
(N) and (F) are :
(a) 6,4 (b) 4,4 (c) 6,6 (d) 3,3

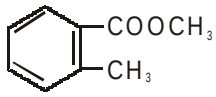
Ans. (a)

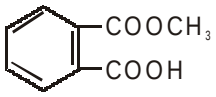
Q.17 

The above reagent can be synthesis from the following compounds in alkaline medium following by acidification :

(a) 

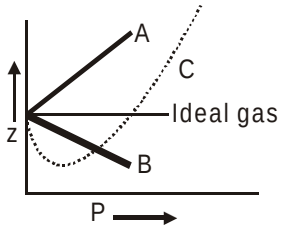
(b) 

(c) 

(d) 

Ans. (a)

Q.18 Which of the following is the only incorrect statement ?



(a) For the gas (A) ; a = 0 and it varies linearly with P

(b) For the gas (B), b = 0 & it varies linearly with pressure.

(c) C represent a typical real gas for which neither a nor b is equal to 0. If minima & the point of intersection is known with Z = 1, a & b can be calculated.

(d) C will represent a typical vander Waals gas whose a & b not equal to zero. If minima of the curve is known then value a & b can be determined.

Ans. (d)

Q.19 When CO_2 is passed through water which one the species present :

(a) $CO_2, H_2CO_3, HCO_3^-, CO_3^{2-}$

(b) HCO_3^-, CO_3^{2-}

(c) CO_2, H_2CO_3

(d) H_2CO_3, HCO_3^-

Ans. (a)

Q.20 The reaction of $MgSO_4$ and $NH_4OH + Na_2HPO_4$ results in the formation of white ppt. The ppt. are of :

(a) $MgNH_4PO_4$ (b) $Mg_3(PO_4)_2$

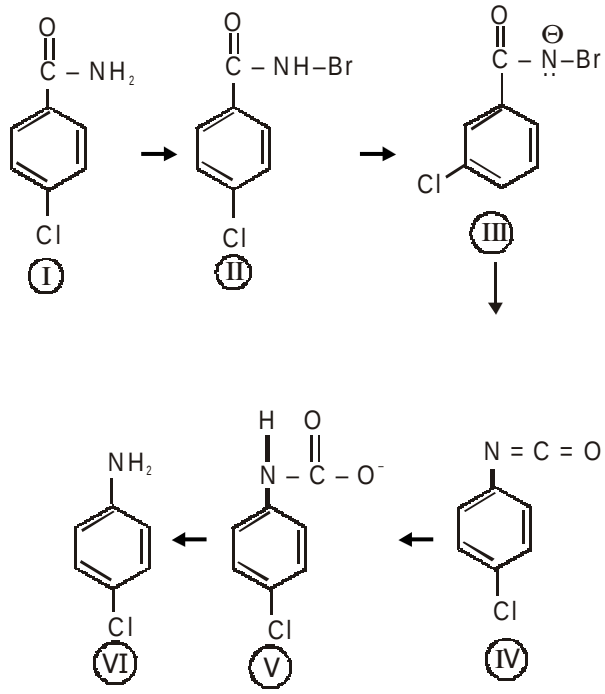
(c) $MgSO_4.MgCl_2$ (d) $MgSO_4.2MgCl_2$

Ans. (a)

Section III : Questions based on comprehensions with one correct answer.

Passage : 1

The reaction sequence given below represents Hoffmann bromamide reaction in which $RCONH_2$ is converted into $R - NH_2$:



Electron donating groups attached to phenyl activates the reaction. The above reaction sequence is interamolecular reaction.

Q.21 The reagent used to convert (I) to (II) is :

(a) Br_2/NaOH (b) KBr/NaOH

(c) NBS (d) KBr

Ans. (a)

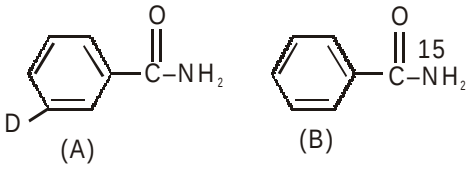
Q.22 Rate determining step of reaction is :

(a) formation of (II) (b) formation of (III)

(c) formation of (IV) (d) formation of (VI)

Ans. (c)

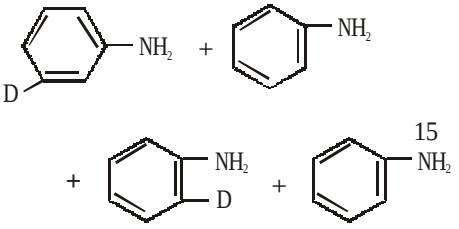
Q.23



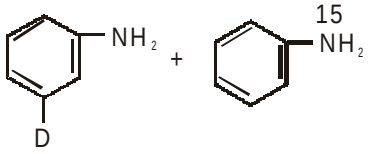
(A) (B)

Products formed when mixture (a) and (b) undergo Hoffmann bromamide degradation ?

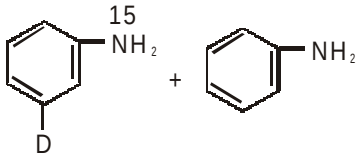
(a)



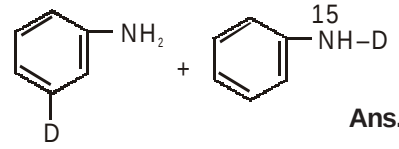
(b)



(c)



(d)



Ans. (b)

Passage : 2

Tollen's reagent is used for the detection of aldehyde when a solution of $AgNO_3$ is added to glucose with NH_4OH then gluconic acid is formed

$Ag^+ + e^- \longrightarrow Ag \qquad E^0 = 0.8\ V$

$C_6H_{12}O_6 + H_2O \longrightarrow C_6H_{12}O_7 + 2H^+ + 2e^-$

$E^0_{oxi} = -0.05V$

$Ag(NH_3)_2^+ + e^- \longrightarrow Ag(s) + 2NH_3$

$E^o = 0.337V$

Q.24 For the following reaction

$$Glucose + H_2O + 2\,Ag^+ \underset{}{\overset{Keq.}{\rightleftharpoons}} \text{Gluconic acid} + 2\,Ag$$

Determine the value of ℓn Keq :

(a) 58.8 (b) 46.2

(c) 28.3 (d) 66.13

Ans. (a)

Q.25 With the increase in concentration of NH_3 pH increases to 11. Consider there is no change in concentration of $C_6H_{12}O_6$ & $C_6H_{12}O_7$ on addition of NH_3.

Which of the following is correct ?

(a) E_{ox} increases by 0.65V from E^o_{ox}

(b) E_{ox} decreases by 0.65V from E^o_{ox}

(c) E_{red} increases by 0.65V from E^o_{red}

(d) E_{red} decreases by 0.65V from E^o_{red}

Ans. (c)

Q.26 Ammonia is always added in this reaction. Which of the following must be incorrect ?

(a) NH_3 easily forms complex with Ag^+

(b) $Ag(NH_3)_2^+$ is a strong oxidising reagent than Ag^+.

(c) In absence of NH_3 silver salt of gluconic acid is formed

(d) NH_3 has affected the standard reduction potential of glucose/gluconic acid electrode.

Ans. (d)

Passage : 3

$NiCl_2$ + KCN(excess) $\longrightarrow$ [Cyano Complex] (I)

$NiCl_2$ + KCl (excess) $\longrightarrow$ [Chloro Complex] (II)

In the product Ni has the coordination number as 4.

Q.27 The IUPAC name of the products formed are :

(a) Potassium tetracyano nickelate (II) & Potassium tetrachloro nickelate (II)

(b) Tetracyano potassium nickelate & Tetrachloro potassium nickelate

(c) Potassium tetracyano nickel (II) & Potassium chloro nickel (II)

(d) Tetracyano nickel (II) & Tetrachloro nickel (II)

Ans. (a)

Q.28 Hybridisation in I and II is :

(a) dsp^2, sp^3 (b) sp^3,sp^3

(c) dsp^2, dsp^2 (d) sp^3d^2 , d^2sp^3

Ans. (a)

Q.29 Which of the following is correct about I and II

(a) Both are diamagnetic

(b) Both are paramagnetic

(c) I^{st} is diamagnetic & II is paramagnetic with two unpaired electrons

(d) I^{st} is diamagnetic & II is paramagnetic with one unpaired electrons

Ans. (c)

Passage : 4

Carbon-14 is used to determine the age of organic material. The procedure is based on the formation of ^{14}C by neutron capture in the upper atmosphere $^{14}_{7}N + {}_{0}n^{1} \longrightarrow {}^{14}_{6}C + {}_{1}p^{1}$, ^{14}C is absorbed by living organisms during photosynthesis. The ^{14}C content is constant in living organism once the plant or animal dies, the uptake of carbon dioxide by it ceases and the level of ^{14}C in the dead being, falls due to the decay which ^{14}C undergoes $^{14}_{6}C \longrightarrow N + \beta^{-}$. The half life period of ^{14}C is 5770 years. The decay constant (λ) can be calculated by using the following formula $\lambda = \frac{0.693}{t_{1/2}}$. The comparison of the β^{-} activity of the dead matter with that of the carbon still in circulation enables measurement of the period of the isolation of the material from the living cycle. The method hoever, ceases to be accurated over periods longer than 30,000 years. The proportion of ^{14}C to ^{12}C in living matter is 1 : 10^{12}.

Q.30 Which of the following is correct ?

(a) In living organism, circulation of ^{14}C from atomosphere is high so the carbon content is constant in organism

(b) Carbon dating can be used to find out the age of earth crust and rocks

(c) Radioactive absorption due to cosmic radiation is equal to the rate of radioactive decay, hence the carbon content remains constant in living organism.

(d) Carbon dating can not be used to determine concentration of ^{14}C in dead beings.

Ans. (c)

Q.31 What should be the age of fossil for meaningful determination of its age ?

(a) 6 years

(b) 6000 years

(c) 60,000 years

(d) It can be used to calculate any age

Ans. (b)

Q.32 A nuclear explosion has taken place leading to increase in concentration of ^{14}C in nearby areas. ^{14}C concentration is C_1 in nearby areas and C_2 in areas far away. If the age of the fossil is determined to be T_1 and T_2 at the places respectively then :

(a) The age of the fossil will increase at the place where explosion has taken place and $T_1 - T_2 = \frac{1}{\lambda} \ell n \frac{C_1}{C_2}$

(b) The age of the fossil will decrease at the place where explosion has taken place and $T_1 - T_2 = \frac{1}{\lambda} \ell n \frac{C_1}{C_2}$

(c) The age of fossil will be determined to be same.

(d) $\frac{T_1}{T_2} = \frac{C_1}{C_2}$

Ans. (b)

Section IV : This section consists of 4 questions. Answers are to be given in between 0000 to 9999 in the form of nearest integer.

Q.33 For a cubical system the following information are available.

Edge length = 5Å ; density = 2 gm/cm^3, Atomic wt. = 75

Determine the radius of the atom in pm ?

Ans. 0217

Q.34 75.2 g phenol is added in (1kg) of the solvent . The depression in freezing point is 7. Calculate the percentage association if phenol undergoes dimerisation (k_f = 14).

Ans. 0075

Q.35 2 moles of CO are mixed with 1 mole of O_2 in a container of 1ℓ. They completely to form 2 moles of CO_2. If the pressure in the vessel changes from 70 atm to 40 atm, what will be the value of ΔU in kJ at 500 K (The gases deviate appreciably from ideal behaviour.)

$2\,CO + O_2 \longrightarrow 2CO_2$; ΔH = -560 kJ/mol,

1 L atm = 0.1 kJ

Ans. ΔU = 0557

Q.36 K_{sp} of AgBr = 12×10^{-14}. To the saturated solution of AgBr, $AgNO_3$ is added at the conc. of 10^{-7}(M) λ_∞ of $Ag^+ = 6 \times 10^{-3}$ ohm^{-1} m^2 mol^{-1}, λ_∞ of $NO_3^- = 7 \times 10^{-3}$ ohm^{-1} m^2 mol^{-1}, λ_∞ of $Br^- = 8 \times 10^{-3}$ ohm^{-1} m^2 mol^{-1}

Ans. 55×10^7 ohm^{-1} m^{-1}.

Section V : This section consists of 4 questions. Each having two columns with 4 entries in each column. Entries of column I are to be matched with column II. One entry of column I may have more than one matching in column II.

Q.37

(a) $SiO_4^{4-} \longrightarrow Si_2O_7^{4-}$	(P) Heat
(b) $B_4O_7^{2-} \longrightarrow B(OH)_3$	(Q) Hydrolysis
(c) $Bi_3+ \longrightarrow [BiO]^+$	(R) Acidification
(d) $AlO_2^- \longrightarrow Al(OH)_3$	(S) Dilution by water

Ans. (a) → P ; (b) → Q & R ; (c) → Q ; (d) → R

Q.38 Match the extraction process listed in Column I with metals listed in Column II :

Column I	Column II
(a) Self reduction	(P) lead
(b) Carbon reduction	(Q) Silver
(c) Complex formation and displacement by metal	(R) Copper
(d) Decomposition of iodide	(S) Boron

Ans. a - P , R ; b - P, R ; c - Q ; d - S

Q.39 According to Bohr's theory ,

E_n = Total energy ; K_n = Kinetic energy

V_n = Potential energy r_n = Radius of n^{th} orbit

Match the following :

Column I	Column II
(a) V_n/K_n = ?	(P) 0
(b) If radius of nth orbital $\propto E_n^x$, x = ?	(Q) –1
(c) Angular momentum in lowest orbital	(R) –2
(d) $\frac{1}{r^n} \propto Z^y$, y = ?	(S) 1

Ans. a→ R ; b→ Q; c→ P; d→ S

Q.40 Match the following

(A)	$Ph–CH_2–CH_2–Br$ & $Ph–CD_2–CH_2–Br$ Reacts with the same rate	(P) E^1 reaction
(B)	$Ph–\underset{\displaystyle Br}{\underset{\vert}{CH}}–CH_3$ reacts faster than $Ph–\underset{\displaystyle Br}{\underset{\vert}{CH}}–CD_3$	(Q) E^2 reaction
(C)	$Ph–CH_2–CH_2–Br \xrightarrow{C_2H_5OD/C_2H_5O^-} Ph–CD=CH_2$	(R) E^1_{CB} Reaction
(D)	$CH_3–\underset{\displaystyle Br}{\underset{\vert}{CH}}–CD_3 \xrightarrow{\text{alc. KOH}} CH_2=CH–CD_3$ (Major Product)	(S) 1st order reaction

Ans. (a) → (P) & (S) ; (b) → (Q) ; (c) → (R) ; (d) → (Q)

IIT-JEE (2006)
(Memory Based Question Paper)
Mathematics

Section I: Multiple Choice Questions with one correct answer.

Q.1 If $t_1 = (\tan\theta)^{\tan\theta}$, $t_2 = (\tan\theta)^{\cot\theta}$, $t_3 = (\cot\theta)^{\tan\theta}$, $t_4 = (\cot\theta)^{\cot\theta}$ and let $\theta \in (0, \frac{\pi}{4})$ then

(a) $t_4 < t_2 < t_1 < t_3$
(b) $t_4 < t_1 < t_3 < t_2$
(c) $t_4 < t_3 < t_2 < t_1$
(d) $t_2 < t_1 < t_3 < t_4$ **Ans. [d]**

Q.2 The axis of parabola is along the line y =x and the distance of vertex from origin is $\sqrt{2}$ and that from its focus is $2\sqrt{2}$. If vertex and focus both lie in the first quadrant, so the equation of parabola is –

(a) $(x-y)^2 = 8(x+y-2)$
(b) $(x-y)^2 = 4(x+y-2)$
(c) $(x-y)^2 = (x+y-2)$
(d) $(x-y)^2 = (x-y-2)$
Ans. [a]

Q.3 $\lim_{x \to 0} \left((\sin x)^{\frac{1}{x}} + \left(\frac{1}{x}\right)^{\sin x} \right)$, for $x > 0$

(a) 0 (b) –1
(c) 2 (d) 1 **Ans. [d]**

Q.4 Given an isoscels triangle, whose one angle is 120° and inradius is $\sqrt{3}$. So the area of triangle is–

(a) 4π (b) $12 + 7\sqrt{3}$
(c) $7+12\sqrt{3}$ (d) $12 - 7\sqrt{3}$
Ans. [b]

Q.5 Let a, b, c be sides of a triangle and any two of them are not equal and $\lambda \in R$. If the roots of the equation. $tx^2 + 2(a+b+c)x + 3\lambda(ab+bc+ca) = 0$ are real, then

(a) $\frac{4}{3} < \lambda < \frac{5}{3}$ (b) $\frac{1}{3} < \lambda < \frac{5}{3}$
(c) $\lambda > \frac{5}{3}$ (d) $\lambda < \frac{4}{3}$
Ans. [d]

Q.6 For which interval for θ, the inequation $(2\sin^2\theta - 5\sin\theta + 2) > 0$. When $0 < \theta < 2\pi$

(a) $\left(\frac{13\pi}{48}, 2\pi\right)$ (b) $\left(0, \frac{\pi}{8}\right) \cup \left(\frac{\pi}{6}, \frac{5\pi}{6}\right)$
(c) $\left(\frac{\pi}{8}, \frac{5\pi}{6}\right)$ (d) $\left(0, \frac{\pi}{6}\right) \cup \left(\frac{5\pi}{6}, 2\pi\right)$
Ans. [d]

Q.7 $\int \frac{x^2-1}{x^3\sqrt{2x^4-2x^2+1}}dx$ is equal to

(a) $\frac{\sqrt{2x^4-2x^2+1}}{2x^2} + c$
(b) $\frac{\sqrt{2x^4-2x^2+1}}{x^3} + c$
(c) $\frac{\sqrt{2x^4-2x^2+1}}{x^2} + c$
(d) $\frac{\sqrt{2x^4-2x^2+1}}{x} + c$
Ans. [a]

Q.8 If $\omega = \alpha+i\beta$ where $\beta \neq 0$ and $z \neq 1$ satisfies the condition that $\left(\frac{\omega-\bar{\omega}z}{1-z}\right)$ is purely real, then set of z is –

(a) $\{z : z = \bar{z}\}$ (b) $\{z : |z| = 1, z \neq 1\}$
(c) $\{z : z \neq 1\}$ (d) $\{z : |z| = 1\}$

Ans. [b]

Q.9 A plane passes through (1, –2, 1) and is perpendicular to two planes $2x - 2y + z = 0$ and $x - y + 2z = 4$. The distance of the plane from point (1, 2, 2) is –

(a) $2\sqrt{2}$ (b) 0
(c) 1 (d) $\sqrt{2}$ **Ans. [a]**

Q.10 If $f''(x) = -f(x)$ and $g(x) = f'(x)$ and $F(x) = \left(f\left(\frac{x}{2}\right)\right)^2 + \left(g\left(\frac{x}{2}\right)\right)^2$ and given that $F(5) = 5$, then F (10) is

(a) 15 (b) 0
(c) 5 (d) 10 **Ans. [c]**

Q.11 Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} + \hat{j} - \hat{k}$. A vector in the plane of $\vec{a}$ and $\vec{b}$ whose projection on $\vec{c}$ is of length $\frac{1}{\sqrt{3}}$ unit is –

(a) $4\hat{i} + \hat{j} - 4\hat{k}$ (b) $4\hat{i} - \hat{j} + 4\hat{k}$
(c) $2\hat{i} + \hat{j} - 2\hat{k}$ (d) $3\hat{i} + \hat{j} - 3\hat{k}$

Ans. [b]

Q.12 If r, s, t are prime numbers and p, q are the postive integers such that the LCM of p,q is $r^2t^4s^2$, then the number of ordered pair (p,q) is –

(a) 224 (b) 225
(c) 252 (d) 256

Ans.[b]

Section II:Multiple Choice Questions with one or more correct answer(s).

Q.13 If $f(x) = \min\{1, x^2, x^3\}$, then

(a) $f'(x) > 0 \ \forall \ x \in R$
(b) f(x) is continuous $\forall \ x \in R$
(c) f(x) is not differentiable for two values of x
(d) f(x) is not differentiable but continuous $\forall \ x \in R$ **Ans. [b, d]**

Q.14 If a hyperbola passes through the focus of the $\frac{x^2}{25}+\frac{y^2}{16} = 1$ and its transverse and conjugate axes coincide with the major and minor axis of ellipse, and product of eccentricities is 1, then

(a) Focus of hyperbola is (5, 0)

(b) Focus of hyperbola is $(5\sqrt{3}, 0)$

(c) The equation of hyperbola is $\frac{x^2}{9}-\frac{y^2}{25}=1$

(d) The equation of hyperbola is $\frac{x^2}{9}-\frac{y^2}{16}=1$

Ans. [a, d]

Q.15 The equation(s) of common tangent(s) to the parabola $y = x^2$ and $y = -(x-2)^2$

(a) $y = -4(x-1)$ (b) $y = 0$
(c) $y = 4(x-1)$ (d) $y = -30x-50$

Ans. [b, c]

Q.16 Internal angle bisector of $\angle A$ of triangle ABC, meets side BC at D. A line drawn through D perpendicular to AD intersects the side AC at P and the side AB at Q. If a, b, c represent the sides of ΔABC then.

(a) $AD = \frac{2bc}{b+c}\cos\frac{A}{2}$

(b) $PQ = \frac{4bc}{b+c}\sin\frac{A}{2}$

(c) The triangle APQ is isosceles
(d) AP is HM of b and c

Ans.[a, b, c, d]

Q.17 A tangent at P(x,y) point on the curve y = f(x) intersects to the axes at A and B points respectively such that AP : BP ≡ 1 : 3, given that f(1) = 1, then–

(a) normal at (1, 1) is x + 3y = 4

(b) equation of curve is 3y + xy′ = 0

(c) curve passes through (2, 1/8)

(d) equation of curve is xy′ – 3y = 0

Ans. [b,c]

Q. 18 f(x) is a cubic polynomial such that f(3) = 18, f(–1) = 2 and f(x) has local maximum at x = –1. If f ′(x) has local maximum at x = 0, then

(a) f(x) is increasing for $x \in [1, 2, \sqrt{5}]$

(b) the distance between (–1, 2) and (a, f(a)) where x = a is the point of local minimum is $2\sqrt{5}$

(c) f(x) has local minima at x = 1

(d) the value of f(0) = 5

Ans. [b c]

Q.19 Let $\vec{A}$ is a vector parallel to line of intersection of planes P_1 and P_2 through origin. P_1 is parallel to the vectors $2\hat{j}+3\hat{k}$ and $4\hat{j}-3\hat{k}$ and P_2 is parallel to $\hat{j}-\hat{k}$ and $3\hat{j}+3\hat{k}$ than angle between vectors $\vec{A}$ and $2\hat{i}+\hat{j}-2\hat{k}$ is–

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$

(c) $\frac{\pi}{6}$ (d) $\frac{3\pi}{4}$

Ans [b, d]

Q.20 Let $f(x) = \begin{cases} e^x & 0 \le x < 1 \\ 2 - e^{x-1} & 1 < x \le 2 \\ x - e & 2 < x \le 3 \end{cases}$ and

$g(x) = \int_0^x f(t)\,dt$, $x \in [1, 3]$ than g(x) has

(a) local maximum at x = 1 and local minimum at x = 2

(b) No local maximum

(c) No point of local minimum

(d) Local maximum point is x = 1 + log 2 and local minimum at x = e **Ans [a, d]**

Section III :Questions based on comprehensions with one correct answer.

Passage – I

Now we define the definite integral using the formula $\int_a^b f(x)\,dx = \frac{b-a}{2}(f(a) + f(b))$, for more accurate result for $c \in (a,b)$,

$$F(c) = \left[\frac{b-a}{2}(f(a)+f(c))\right] + \left[\frac{b-c}{2}(f(b)+f(c))\right]$$

when $c = \frac{a+b}{2}$,

$$\int_a^b f(x)\,dx = \left(\frac{b-a}{4}\right)(f(a)+ f(b) + 2f(c))$$

Q.21 Evaluate $\int_0^{\frac{\pi}{2}} \sin x\,dx$

(a) $\frac{\pi}{8\sqrt{2}}(1+\sqrt{2})$ (b) $\frac{\pi}{8}(1+\sqrt{2})$

(c) $\frac{\pi}{4}(1+\sqrt{2})$ (d) $\frac{\pi}{4}(1+2\sqrt{2})$

Ans [b]

Q.22 If f ′(x) < 0, ∀ x ∈ (a,b) and c is a point such that a < c < b, and (c, f (c)) is the point lying on the curve for which F(c) is maximum, then f ′(c) is equal to

(a) $\frac{f(b)-f(a)}{b-a}$ (b) $\frac{2(f(b)-f(a))}{b-a}$

(c) $\frac{2f(b)-f(a)}{2b-c}$ (d) 0

Ans [a]

Q.23 $\lim_{t \to a} \frac{\int_a^t f(x)\,dx - \left(\frac{t-a}{2}\right)(f(t)+f(a))}{(t-a)^3}$ exists,

then which of the following is the atmost degree of function f(x) is

(a) 1 (b) 2

(c) 3 (d) 4

Ans [d]

Passage – II

Total n urns each containing (n+1) balls such that the i^{th} urn contains i white balls and (n + 1 – i) red balls.

Now u_i be the event of selecting i^{th} urn, i = 1, 2, 3 .... n and w denotes the event of getting a white ball.

Q.24 If $P(u_i) \propto i$, where i = 1, 2, 3 , ... n, then $\lim_{n \to \infty} P(w)$ is equal to

(a) $\frac{2}{3}$ (b) 1

(c) $\frac{3}{4}$ (d) $\frac{1}{4}$

Ans [a]

Q.25 If $P(u_i) = c$, where c is a constant then $P(u_n/w)$ is equal to

(a) $\frac{2}{n+1}$ (b) $\frac{n}{n+1}$

(c) $\frac{1}{n+1}$ (d) $\frac{1}{2(n+1)}$

Ans [a]

Q.26 If n is even and E denotes the event of choosing even numbered urn and also $P(u_i) = \frac{1}{n}$, then find the value of P (w/E)

(a) $\frac{n+2}{2(n+1)}$ (b) $\frac{n+2}{2n+1}$

(c) $\frac{n}{n+1}$ (d) $\frac{1}{n+1}$

Ans [a]

Passage – III

Let C_1 is a circle touching to all the sides of square ABCD of side length 2 units internally and C_2 circle is passing through the vertices of square. A line L is drawn through A.

Q.27 Let P is a point on C_1 and Q is on C_2, then $\frac{PA^2 + PB^2 + PC^2 + PD^2}{QA^2 + QB^2 + QC^2 + QD^2}$ =

(a) 0.75 (b) 0.5

(c) 1.25 (d) 1

Ans. [a]

Q.28 A variable circle touches to the line L and circle C_1 externally such that both circles are on the same side of the line, then the locus of center of variable circle is –

(a) ellipse (b) circle

(c) Hyperbola (d) parabola

Ans. [d]

Q.29 A line M through A is drawn parallel to BD. Locus of point R, which moves such that its distances from the line BD and the vertex A are equal, cuts to line M at T_2 and T_3 and AC at T_1, then area of triangle $T_1T_2T_3$ is

(a) $\frac{1}{2}$(sq.units) (b) 2(sq.units)

(c) 1 (sq.units) (d) $\frac{4}{3}$(sq.units)

Ans. [c]

Passage – IV

If $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & -1 \\ 1 & 1 & 0 \end{bmatrix}$, if U_1, U_2 and U_3 are column matrices satisfying

$A\underline{U}_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$, $A\underline{U}_2 = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}$, $A\underline{U}_3 = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$, and

U is 3×3 matix whose columns are U_1, U_2, U_3 then answer the following questions.

Q.30 The value of |U| is –

(a) 2 (b) 3

(c) 6 (d) 12

Ans. [b]

Q.31 Sum of the elements of U^{-1} is –

(a) 1/12 (b) 1/6

(c) 1/3 (d) 1/4

Ans. [c]

Q.32 Find the value of –

$[3 \quad 2 \quad 0]\ U \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix}$ is -

(a) 13 (b) 26

(c) 12 (d) 24

Ans. [a]

Section IV : This section consists of 4 questions. Answers are to be given in between 0000 to 9999 in the form of nearest integer.

Q.33 If roots of $x^2-10cx-11d=0$ are a, b and the roots of $x^2-10ax-11b=0$ are c, d, then the value of a+b+c+d is equal to (a,b,c,d are different numbers) ……

Ans. [1210]

Q.34 The value $5050\dfrac{\int_0^1\left(1-x^{50}\right)^{100}dx}{\int_0^1\left(1-x^{50}\right)^{101}dx}$ is equal to ……

Ans [5051]

Q.35 Let $a_n=\dfrac{3}{4}-\left(\dfrac{3}{4}\right)^2+\left(\dfrac{3}{4}\right)^3-\ldots\ldots\ldots\ldots$ $(-1)^{n-1}\left(\dfrac{3}{4}\right)^n$ and $b_n=1-a_n$ then find the natural number n_0 such that $b_n>a_n$, $n>n_0$. is…….

Ans [0005]

Q.36 If f(x) is twice differentiable and f(a) = 0, f(b) = 2, f(c) = –1, f(d) = 2, f(e) = 0, where a < b < c < d < e then the minimum number of zeroes of $g(x)=\{f'(x)\}2+\{f''(x)f(x)\}$ in [a,e] is ?

Ans.[0006]

Section V: This section consists of 4 questions. Each having two columns with 4 entries in each column. Entries of column I are to be matched with column II. One entry of column I may have more than one matching in column II.

Q.37 Three normals drawn at P,Q and R on the parabola $y^2=4x$ intersect at (3, 0). Then

Column I	**Column II**
(a) Radius of circumcircle of Δ PQR	(p) 5/2
(b) Area of Δ PQR	(q) (5/2, 0)
(c) Centroid of Δ PQR	(r) (2/3, 0)
(d) circumcentre of Δ PQR	(s) 2

Ans.–

(a) → (p)
(b) → (s)
(c) → (r)
(d) → (q)

Q.38 Column I

(a) Area bounded by $-4y^2=x$ and $x-1=-5y^2$ (p) 0

(b) cosine of the angle of intersection of curves $y=x^x-1$ and $y=3^{x-1}\log x$ (q) 6 ln 2

(c) $\int_0^{\pi/2}(\sin x)^{\cos x}\left(\cos x.\cot x-\log(\sin x)^{\sin x}\right)dx$ (r) 4/3,

(d) Not available (s) 1,

Ans.–

(a) → (r)
(b) → (s)
(c) → (s)

Q.39 (a) $\sum_{i=1}^{\infty}\tan^{-1}\left(\dfrac{1}{2i^2}\right)=t$, then tan t = (p) 0

(b) A line perpendicular to $x+2y+2z=0$ and passes through (0, 1, 0) then the perpendicular distance of the line from origin is (q) $\dfrac{\sqrt{5}}{3}$

(c) Not available (r) 1

(d) Not available (s) 2/3

Ans.–

(a) → (r)
(b) → (s)

Column I

Q.40(a) Two rays in the Ist quadrant ax–y = 1 and x + y = |a| cut each other in the Interval $a \in (a_0, \infty)$ the value of a_0 is

(b) sinA sinB sinC + cosAcosB = 1 then sinC =

(c) $\left|\int_0^1 (1-y^2)dy\right| + \left|\int_1^0 (y^2-1)dy\right|$

(d) Let $\vec{a} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$, $\hat{k}\times(\hat{k}\times\vec{a}) = \vec{0}$ and a point (α,β,γ) lies on plane x + y + z = 2, then γ =

Column II

(p) 4/3

(q) $\left|\int_0^1 \sqrt{1-x}dx\right| + \left|\int_{-1}^0 \sqrt{1+x}\,dx\right|$

(r) 1

(s) 2

Ans.–

(a) → (r)

(b) → (r)

(c) → (p) & (q)

(d) → (s)