From Long Term Classroom Programs and Medium / Short Classroom Program 4 in Top 10, 10 in Top 20, 43 in Top 100, 75 in Top 200, 159 in Top 500 Ranks & 3542 total selections in IIT-JEE 2012

ALL INDIA TEST SERIES

FIITJEE

JEE (Advanced), 2013

CONCEPT RECAPITULATION TEST
(Set – VI)

Paper 2

Time Allotted: 3 Hours **Maximum Marks: 240**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains Three Parts.
3. **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
4. Each part is further divided into three sections: **Section-A, Section-B & Section–C**.
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with black pen for each character of your Enrolment No. and write your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Three Parts.

(i) **Section-A (01 – 08)** contains 8 multiple choice questions which have only one correct answer. Each question carries **+3 marks** for correct answer and **– 1 mark** for wrong answer.

Section-A (09 – 12) contains 4 multiple choice questions which have more than one correct answer. Each question carries **+4 marks** for correct answer. There is no negative marking.

(ii) **Section-B (01 – 02)** contains 2 Matrix Match Type questions containing statements given in 2 columns. Statements in the first column have to be matched with statements in the second column. Each question carries **+8 marks** for all correct answer. For each correct row **+2 marks** will be awarded. There may be one or more than one correct choice. No marks will be given for any wrong match in any question. There is no negative marking.

(iii) **Section-C (01 – 06)** contains 6 Numerical based questions with single digit integer as answer, ranging from 0 to 9 and each question carries **+4 marks** for correct answer. There is no negative marking.

Name of the Candidate	
Enrolment No.	

Useful Data

PHYSICS

Acceleration due to gravity	$g = 10\ m/s^2$
Planck constant	$h = 6.6 \times 10^{-34}$ J-s
Charge of electron	$e = 1.6 \times 10^{-19}$ C
Mass of electron	$m_e = 9.1 \times 10^{-31}$ kg
Permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/N\text{-}m^2$
Density of water	$\rho_{water} = 10^3\ kg/m^3$
Atmospheric pressure	$P_a = 10^5\ N/m^2$
Gas constant	$R = 8.314\ J\ K^{-1}\ mol^{-1}$

CHEMISTRY

Gas Constant	R	=	$8.314\ J\ K^{-1}\ mol^{-1}$
		=	0.0821 Lit atm $K^{-1}\ mol^{-1}$
		=	$1.987 \approx 2$ Cal $K^{-1}\ mol^{-1}$
Avogadro's Number	N_a	=	6.023×10^{23}
Planck's constant	h	=	6.625×10^{-34} J·s
		=	6.625×10^{-27} erg·s
1 Faraday		=	96500 coulomb
1 calorie		=	4.2 joule
1 amu		=	1.66×10^{-27} kg
1 eV		=	1.6×10^{-19} J

Atomic No: H=1, He = 2, Li=3, Be=4, B=5, C=6, N=7, O=8, N=9, Na=11, Mg=12, Si=14, Al=13, P=15, S=16, Cl=17, Ar=18, K =19, Ca=20, Cr=24, Mn=25, Fe=26, Co=27, Ni=28, Cu = 29, Zn=30, As=33, Br=35, Ag=47, Sn=50, I=53, Xe=54, Ba=56, Pb=82, U=92.

Atomic masses: H=1, He=4, Li=7, Be=9, B=11, C=12, N=14, O=16, F=19, Na=23, Mg=24, Al = 27, Si=28, P=31, S=32, Cl=35.5, K=39, Ca=40, Cr=52, Mn=55, Fe=56, Co=59, Ni=58.7, Cu=63.5, Zn=65.4, As=75, Br=80, Ag=108, Sn=118.7, I=127, Xe=131, Ba=137, Pb=207, U=238.

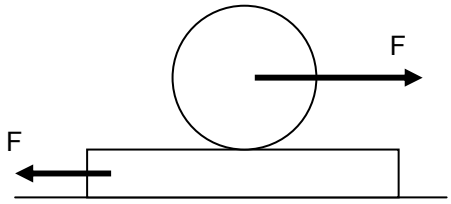
Physics

PART – I

SECTION – A
Single Correct Choice Type

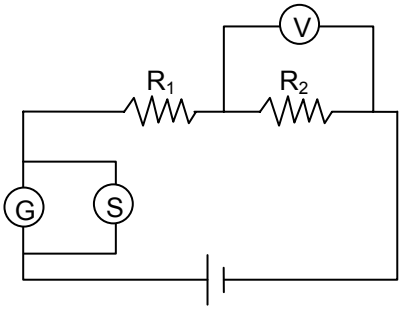
This section contains **8 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. A uniform disc is lying on a board of same mass. Equal and opposite forces have been applied on the disc and the board as shown in figure. The horizontal surface, on which the board is placed, is frictionless surface. No slipping takes place between the disc and the board. Initially the whole system was in the state of rest. If at any instant the centre of the disc has a velocity V with respect to earth then its angular velocity will be equal to



(A) V/R
(B) V/2R
(C) 2V/R
(D) V/3R

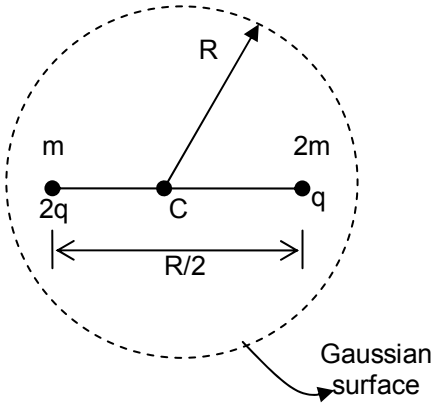
2. If the reading of galvanometer is 5 mA what is current through shunt? Resistances of galvanometer and shunt are 10 Ω and 0.1 Ω respectively.



(A) $\frac{5}{101}$mA
(B) $\frac{500}{101}$mA
(C) 5mA
(D) zero

Rough work

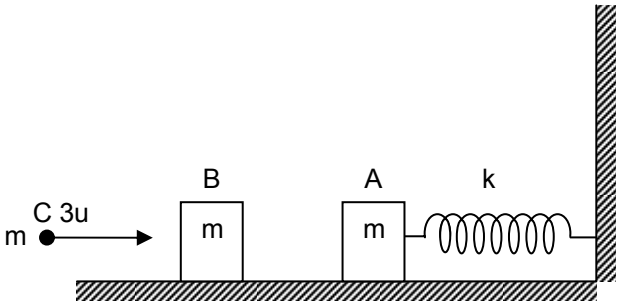
3. System is released from rest. Find the flux of electric field due to the charges through the gaussian surface at the moment when charge q just reaches outside the surface.



(A) $\frac{q}{\varepsilon_0}$ (B) $\frac{2q}{\varepsilon_0}$

(C) $\frac{3q}{\varepsilon_0}$ (D) zero

4. Find maximum compression in spring. Given that initially the spring is in its natural length, each collision is perfectly inelastic and all surfaces are smooth.



(A) $u\sqrt{\frac{m}{3k}}$

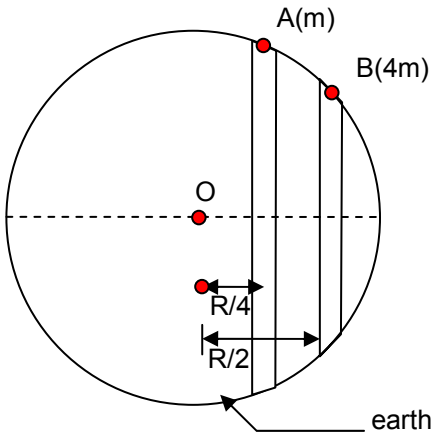
(B) $u\sqrt{\frac{3k}{m}}$

(C) $u\sqrt{\frac{m}{5k}}$

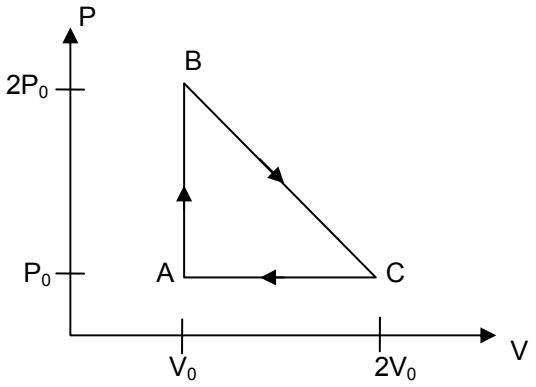
(D) $u\sqrt{\frac{3m}{k}}$

Rough work

5. Two particles A and B (of masses m and 4m) are released from rest in the two tunnels as shown in the figure. Which particle will cross the equatorial plane first?
(A) A
(B) B
(C) both simultaneously
(D) data insufficient



6. In which of the following process temperature first decreases then increase ?
(A) A $\rightarrow$ B
(B) B $\rightarrow$ C
(C) C $\rightarrow$ A
(D) none of these



7. If nuclei of a radioactive element is produced at constant rate α and they decays with decay constant λ. At t = 0, number of nuclei is zero than the number of nuclei at time t is

(A) $\frac{\alpha}{\lambda}(1-e^{-\lambda t})$ (B) $\alpha-\frac{\alpha}{\lambda}e^{-\lambda t}$

(C) $\frac{\alpha}{\lambda}e^{-\lambda t}$ (D) $\alpha(1-e^{-\lambda t})$.

Rough work

8. For a certain plane reflecting surface, the unit vector along the incident ray is $\hat{i}$ and that along the outward normal of the surface is $\left(-\frac{\hat{i}}{2}-\frac{\sqrt{3}}{2}\hat{j}\right)$. The unit vector along the reflected ray will be

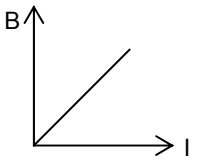
(A) $\frac{\hat{i}}{2}+\frac{\sqrt{3}}{2}\hat{j}$ (B) $\frac{\hat{i}}{2}-\frac{\sqrt{3}}{2}\hat{j}$

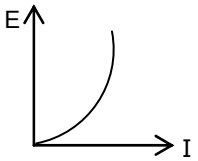
(C) $-\frac{\sqrt{3}}{2}\hat{i}+\hat{j}$ (D) $-\frac{\sqrt{3}}{2}\hat{i}-\frac{1}{2}\hat{j}$

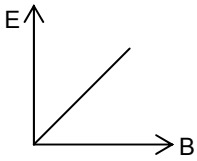
Multiple Correct Answer(s) Type

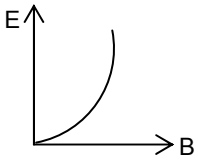
This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE are correct**.

9. If B and E denote induction of magnetic field and magnetic energy density at the midpoint of along solenoid carrying a current I, then which of the following graphs is/are correct?

(A) 

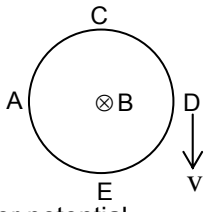
(B) 

(C) 

(D) 

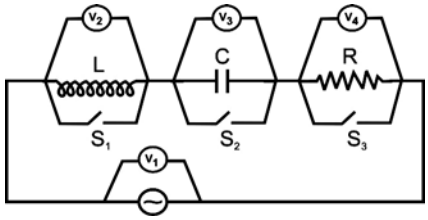
Rough work

10. A vertical conducting ring of radius R falls vertically in a horizontal magnetic field of magnitude B. The direction of B is ⊗. When the speed of the ring is v



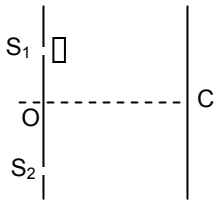
(A) no current flows in the ring
(B) A and D are at the same potential
(C) C and E are at the same potential
(D) the potential difference between A and D is 2BRv, with D at a higher potential

11. In the figure frequency of the A.C. source is $50/\pi$ Hz with L = 100 H, C = 1 μF, R = 10kΩ. When all the switches are open V_2 reads 100 V. All the voltmeters are hot wire voltmeter which read r.m.s. value of voltage. Initially S_1, S_2 and S_3 are open.



(A) At any instant voltage across R increases at that instant magnitude of potential difference across inductor and capacitor simultaneously increases or decreases
(B) Reading of all other voltmeters are also equal to 100 V
(C) When S_1 and S_2 both closed reading of V_4 remains 100 V
(D) When S_1 closed and S_2 is opened reading of V_4 decreases

12. A YDSE is performed in a medium of refractive index μ_1. In front of one of the slits say S_1 as shown a thin glass slab of refractive index $\mu_2 (< \mu_1)$ is kept. If initially the central maxima was formed on the central line OC then



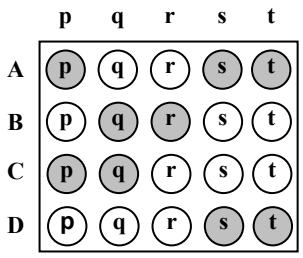
(A) central maxima will shift upwards
(B) central maxima will shift downwards
(C) the waves reaching on the screen at C from S_1 will lead the waves reaching from S_2
(D) the waves reaching C from S_1 will lag from the waves reaching from S_2

Rough work

SECTION - B

Matrix – Match Type

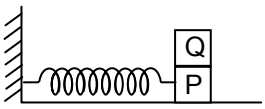
*This section contains 2 questions. Each question contains statements given in two columns, which have to be matched. The statements in **Column I** are labelled A, B, C and D, while the statements in **Column II** are labelled p, q, r, s and t. Any given statement in **Column I** can have correct matching with **ONE OR MORE** statement(s) in **Column II.** The appropriate bubbles corresponding to the answers to these questions have to be darkened as illustrated in the following example:*
If the correct matches are A – p, s and t; B – q and r; C – p and q; and D – s and t; then the correct darkening of bubbles will look like the following:



1. In LCR series circuit suppose ω_r is the resonance frequency, then match the following table.

	Column – I	Column – II
(A)	If $\omega > \omega_r$	(p) current will lead the voltage
(B)	If $\omega = \omega_r$	(q) voltage will lead the current
(C)	If $\omega = 2\omega_r$	(r) $X_L = 2X_C$
(D)	If $\omega < \omega_r$	(s) Current and voltage are in phase
		(t) none of these

2. Match the following :
A block P of mass m placed on smooth horizontal surface and connected with a spring. Another block Q of same mass is placed on the block P.
The two blocks are pulled by a distance A and released. The blocks oscillates without slipping on each other. Then match the matrix.



Column – I	Column – II
(A) Friction force on the block Q, When both block coming towards equilibrium position form left. (exclude the equilibrium position)	(p) towards right
(B) Friction force at the block Q when both block going right from equilibrium position. (exclude the equilibrium position)	(q) towards left
(C) Friction force will be maximum on Q.	(r) at equilibrium position
(D) Friction force on P when both block is coming towards the equilibrium position from right. (exclude the equilibrium position)	(s) At extreme position
	(t) none of these

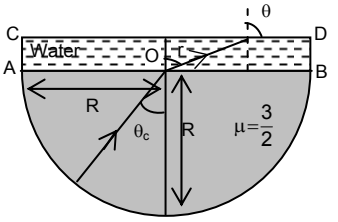
Rough work

SECTION –C
Integer Answer Type

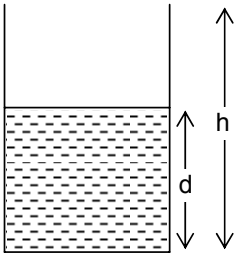
This section contains **6 questions.** The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

1. A point charge –Q is placed at the centre of a uniformly charged ring of charge Q. Electric field at a point on the axis of ring at a distance x (x >>R) varies as $E\alpha\frac{1}{x^n}$ find n.

2. A ray of light traveling in glass (μ = 3/2) is incident on a horizontal glass air surface at the critical angle θ_C. If a thin layer of water (μ = 4/3) is now poured on the glass air surface, the ray of light emerge into air at the water air surface at an angle of π / k radians find the value of k.

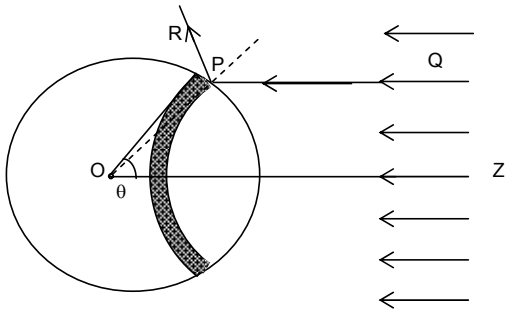


3. Consider the situation in the figure. A plane mirror is fixed at a height h above the bottom of a beaker containing water (refractive index μ) upto a height d. The position of the image of the bottom formed by the mirror from the mirror is $h - d + \frac{kd}{\mu}$. Find the value of k.

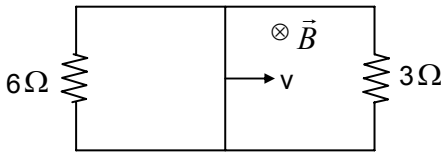


Rough work

4. A perfectly reflecting solid sphere of radius r is kept in the path of a parallel beam of light of large aperture. If the beam carries an intensity I, The force exerted by the beam on the sphere is $\frac{\pi r^2 kI}{2c}$. Find the value of k.



5. A rectangular loop with a sliding connector of length *l* = 1.0 m is situated in a uniform magnetic field B = 2 T perpendicular to the plane of loop. Resistance of connector is $r = 2\Omega$. Two resistances of 6Ω and 3Ω are connected as shown in figure. The external force required to keep the connector moving with a constant velocity *v* = 2 m/s is



6. A point charge q is placed at the centre of hollow conducting sphere of inner radius R and outer radius 2R. Work done required to slowly remove the point charge from centre to infinity (through a small orifice) is $\frac{1}{n}\frac{Q^2}{4\pi\varepsilon_0 R}$ find n.

Rough work

Chemistry

PART – II

SECTION – A

Straight Objective Type

This section contains 8 multiple choice questions numbered 1 to 8. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. Nylon – 6, 10 is obtained by
   (A) condensation of adipic acid &hexamethylenediammine.
   (B) condensation of ethylene glycol and Phthalic acid
   (C) condensation of melamine and formaldehyde
   (D) hexamethylenediammine and sebacic acid [$HOOC-(CH_2)_8-COOH$]

2. The vapour pressures of two pure liquids 'A' and 'B' that form an ideal solution are 100 and 500 torr respectively at temperature 'T'. This liquid solution of A and B is composed of 1 mole of 'A' and 1 mole of B. What will be the pressure when given of mixture has been vaporized?
   (A) 800 torr (B) 500 torr
   (C) 300 torr (D) 400 torr

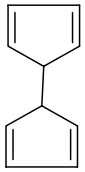
3. Which of the following structure is non planar
   (A) $Na_3B_3O_6$ (B) I_2Cl_6
   (C) sheet silicate (D) inorganic graphite layer

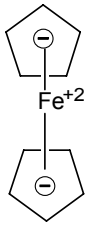
4. When 1 g oxalic acid is burnt in a bomb calorimeter whose heat capacity is 8.75 kJ/K the temperature increases by 0.312 K. The enthalpy of combustion of oxalic acid at 27^oC is
   (A) – 240.7 kJ/mol (B) – 245.7 kJ/mol
   (C) – 246.95 kJ/mol (D) – 180 kJ/mol

5. 10 mole of an ideal gas is heated at constant pressure of one atmosphere from 27^oC to 127^oC if $C_{V.m}= 20 + 10^{-2}$ T. Jk^{-1} mol^{-1} then, ΔH for the process is [T is temperature in Kelvin, assuming C_v does not changes with temperature]
   (A) 3000 J (B) 3350 J
   (C) 3700 J (D) 30350 J

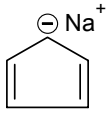
Rough work

6. Consider the following reactions
Cyclopentadiene + Na → C + H_2
2C + $FeCl_2$ → D + 2NaCl
Identify D.

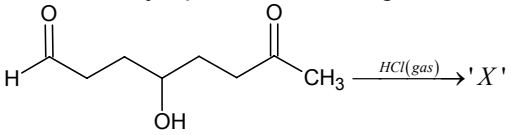
(A) 

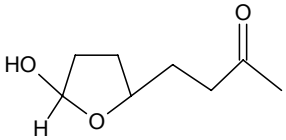
(B) 

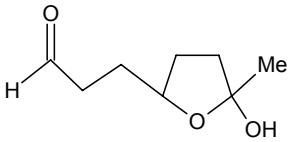
(C) 

(D) 

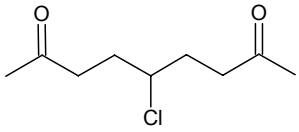
7. Give the major product X of the given reaction



(A) 

(B) 

(C) Both (A) and (B) is equal amounts

(D) 

8. An aqueous solution containingPb^{++}, Cu^{++}, Hg^{++}, Ca^{++}, Bi^{+++}, Co^{+++}, Mn^{++}, Ni^{++}, Zn^{++}cation subject to precipitated as sulphide by passing H_2S gas which one is true regarding
(A) all cations are precipitated in high concentration of HCl acid.
(B) Pb^{++}, Cu^{++}, Hg^{++}, Cd^{++}, Bi^{+++}will not be precipitated in high concentration of HCl acid.
(C) all cations are precipitated in the solution made basic by sodium hydroxide.
(D) only Co^{3+}, Mn^{++}, Ni^{++}, Zn^{++} will be precipitated in the basic buffer of NH_4OH and NH_4Cl.

Rough work

Multiple Correct Choice Type

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out which **ONE OR MORE** is/are correct.

9. Select the correct statement(s)
   (A) Benzene is does not give test for unsaturation.
   (B) A positive catalyst can change ΔH of the reaction
   (C) A mixture of reactants may be thermodynamically unstable but kinetically stable
   (D) A negative catalyst increases the activation energy of the reaction.

10. Select incorrect statement(s)
   (A) If the value of l = 0, the electron density distribution is spherical
   (B) The shape of the orbital is given by magnetic quantum number
   (C) Orbital angular momentum of 1s, 2s, 3s electrons are equal
   (D) In an atom all the electrons travel with the same velocity

11. Which of the following mechanism is/are predictable for reaction
   $2H_2(g) + 2NO(g) = N_2(g) + 2H_2O(g)$; the rate law expression = $K[H_2][NO]^2$

   (A) $H_2 + NO \rightarrow H_2O + N$ (slow)
   $N + NO \rightarrow N_2 + O$ (fast)
   $O + H_2 \rightarrow H_2O$ (fast)

   (B) $H_2 + 2NO \rightarrow N_2O + H_2O$ (slow)
   $N_2O + H_2 \rightarrow N_2 + H_2O$ (fast)

   (C) $2NO \rightleftharpoons N_2O_2$ (fast equilibrium)
   $N_2O_2 + H_2 \rightarrow N_2O + H_2O$ (slow)
   $N_2O + H_2 \rightarrow N_2 + H_2O$ (fast)

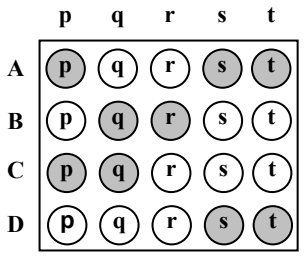
   (D) $2H_2(g) + 2NO(g) \rightarrow N_2(g) + 2H_2O(g)$

12. Select the correct statement(s):
   (A) Bond angle H – N – H in NH_3 is more than H-O-H bond angle in water
   (B) In PCl_5 molecules, axial and equatorial bonds are of equal length
   (C) H_2S is having higher boiling point than H_2O
   (D) N_2 has higher bond order than N_2^+

Rough work

SECTION-B
(Matrix Type)

This section contains 2 questions. Each question contains statements given in two columns, which have to be matched. The statements in **Column I** are labelled A, B, C and D, while the statements in **Column II** are labelled p, q, r, s and t. Any given statement in **Column I** can have correct matching with **ONE OR MORE** statement(s) in **Column II.** The appropriate bubbles corresponding to the answers to these questions have to be darkened as illustrated in the following example:

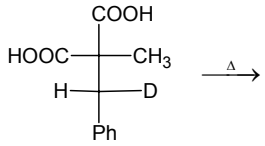
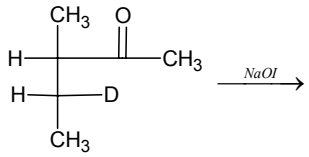
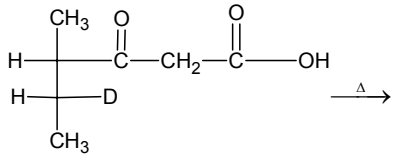
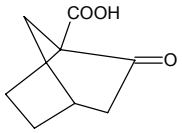


If the correct matches are A – p, s and t; B – q and r; C – p and q; and D – s and t; then the correct darkening of bubbles will look like the following:

1. Match the following:

Column - I	**Column-II**
(A) Potential energy of e^-	(p) $\frac{2\pi^2me^4}{h^3c}$
(B) Kinetic energy of e^-	(q) $-\frac{2\pi^2mz^2e^4}{n^2h^2}$
(C) Energy of e^-	(r) $\frac{2\pi^2mz^2e^4}{n^2h^2}$
(D) Rydberg's constant R_H	(s) $-\frac{4\pi^2mz^2e^4}{n^2h^2}$

2. Match the following:

Column-I	**Column-II**
(A) 	(p) Diastereomers
(B) 	(q) Enantiomers
(C) 	(r) Single optically active compound
(D) 	(s) No reaction
	(t) CO_2 is released

Rough work

SECTION –C
Integer Answer Type

This section contains **6 questions.** The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

1. In an atom two electrons move around the nucleus in circular orbit of radii R and 4R. The ratio of the time taken by them to complete one revolution is $1:x$, where x is

2. $SrTiO_3$ has a cubic unit cell in which Ti is present at cube centre and O at each face centre and Sr at each corner if co-ordination number of Sr is 2x. Find x.

3. A metal has a density of 4.54 g/cc and an edge length of 412.6 pm. (Molecular weight of metal = 48 g mol^{-1}). Find the rank of unit cell.

4. The compound AX_4 is tetrahedral. What is the number of $\angle XAX$ formed in the compound.

5. A compound of iron and chlorine ($FeCl_x$) is soluble in water. An excess of silver nitrates was added to precipitate the chloride ion as silver chloride. If a 134.8 mg of the compound gave 304.8 mg of AgCl. What is the value of x?

6. A compound 'A' $\left(C_5H_9Br\right)$ doesn't react with Br_2 water, but forms 'B' $\left(C_5H_8\right)$ on treatment with $NaOH/C_2H_5OH$, which reacts with Br_2 water. Ozonolysis of 'B' forms 'C',($C_5H_8O_2$ which contains a chiral carbon having both –CHO and $-\overset{\overset{O}{\|}}{C}-$ group). Number of geometrical isomers possible in A is

Rough work

Mathematics PART – III

SECTION – A

Straight Objective Type

This section contains **8 multiple choice questions** numbered 1 to 8. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. Let $f(r) = \sum_{j=2}^{n}\left(\frac{1}{j^r}\right)$, if the value of $\sum_{r=2}^{\infty} f(r) = \frac{2012}{2013}$ then the value of n is

   (A) 2011 (B) 2012
   (C) 2013 (D) 2014

2. Let three numbers be $A = 2^2 \times 3^3 \times 5$, $B = 7^2 \times 13 \times 17$, $C = 2 \times 3 \times 5 \times 7 \times 11 \times 13 \times 17$. A number is chosen from A or B and is factorized then a non unit factor of this number is selected if this factor divides C then the probability that it is taken from A is

   (A) $\frac{2}{3}$ (B) $\frac{3}{7}$
   (C) $\frac{7}{24}$ (D) $\frac{1}{3}$

3. If 36 people are to be seated around a square table 9 each side then the probability that a particular child always sit between its parents on the same side of table is $\frac{p}{q}$ where p and q are co–prime to each other then p + q is

   (A) 766 (B) 796
   (C) 765 (D) 795

4. A function f(x) is given as $f(x) = ||x^2 - 10x + 21| - p|$. Then the set of values of P such that f(x) has exactly 6 points of non derivability is

   (A) $p \in (4, \infty)$ (B) $p \in [0, 4]$
   (C) $p \in (-4, 4)$ (D) $p \in (0, 4)$

Rough work

5. If α and β are the roots of the quadratic equation $4x^2 + 2x - 1 = 0$ then the value of $\left[\sum_{r=1}^{\infty}\left(\alpha^r + \beta^r\right)\right]$ is
(A) 2 (B) 3
(C) 0 (D) 6

6. Let A polynomial $f(x) = x^4 + x^3 + x^2 + x^1 + 1$ is given. Then the remainder when $f(x^5)$ is divided by f(x) is
(A) 2 (B) 3
(C) a monic polynomial of degree 2 (D) 5

7. If α be the set of integral values of c for which the equation $\cos 2x + c \sin x = 2c - 7$ has solutions then find the number of distinct symmetric matrices of order 3 × 3 whose trace is 18 and entries are from the set α.
(A) 100 (B) 125
(C) 150 (D) 180

8. If $P = \int_{-2}^{2} x\ell n\left(a^x + b^x + c^x + d^x + ...\right)dx$ where a, b, c, d ……. all are the factors of 1000 taken in any order then the value of P is
(A) 8 ℓn 1000 (B) 1000 ℓn 8
(C) 8 ℓn 10 (D) 10 ℓn 8

Multiple Correct Answer(s) Type

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE are correct**.

9. Which of the following functions are continuous at x = 0 if for all of them f(0) = 1

(A) $f(x) = \dfrac{\sin\left(\tan^2 x\right)}{\left(e^{|\sin x|} - 1\right)\sqrt{x^2}}$ (B) $f(x) = \dfrac{90\sin(x^o)}{\left(\sqrt{x + \pi^2} - \sqrt{\pi^2 - x}\right)\pi^2}$

(C) $f(x) = \dfrac{\sin\left[\left(\pi - \dfrac{15}{7}\right)x\right]\sin^{-1}\pi x}{\tan\left(\dfrac{22}{7}x\right)}$ (D) $f(x) = |x|^{[\cos x]}$

Rough work

10. If f(x) be a cubic polynomial and $\lim_{x\to 0}\frac{\sin^2 x}{f(x)}=\frac{1}{3}$ then f(1) can be equal to

(A) 0 (B) 3
(C) 31 (D) 3^{31}

11. Three matrices are given as $A=\begin{bmatrix}\alpha^2 & 4 & 6\\ 9 & \beta^4 & 7\\ 1 & 2 & 2\gamma^2\end{bmatrix}$, $B=\begin{bmatrix}2\beta^2 & -1 & 0\\ 2 & \gamma^2-2\gamma & 1\\ 1 & 9 & 2\alpha-1\end{bmatrix}$, $C=\begin{bmatrix}\gamma & 2 & 1\\ 1 & \alpha & 1\\ 2 & 0 & \beta\end{bmatrix}$ if Tr(A) = Tr(B) – 2 and $\alpha, \beta, \gamma \in R$ then det(c) can be

(A) –1 (B) 2
(C) 5 (D) 0

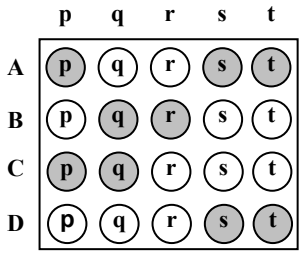
12. Locus of the point of intersection of two perpendicular tangents to an ellipse is $x^2 + y^2 = 25$. Then the equation of tangents to such ellipse at its point of intersection with the line y = x can be (length of semi major and semi minor axis of the ellipse are integers)

(A) 16x + 9y = 60 (B) 16x + 9y + 60 = 0
(C) 9x + 16y = 60 (D) 9x + 16y + 60 = 0

SECTION – B

Matrix – Match Type

This section contains 2 questions. Each question contains statements given in two columns, which have to be matched. The statements in **Column I** are labelled A, B, C and D, while the statements in **Column II** are labelled p, q, r, s and t. Any given statement in **Column I** can have correct matching with **ONE OR MORE** statement(s) in **Column II.** The appropriate bubbles corresponding to the answers to these questions have to be darkened as illustrated in the following example:
If the correct matches are A – p, s and t; B – q and r; C – p and q; and D – s and t; then the correct darkening of bubbles will look like the following:



1. Match the following column–I with column–II.

Column–I		Column–II	
(A)	If two distinct chords of a parabola $y^2 = 4ax$ passing through the point (a, 2a) are bisected by the line x + y = 1, then the length of latus rectum can be	(p)	–1
(B)	The parabola $y = x^2 – 5x + 4$ cuts the x-axis at P and Q. A circle is drawn through P and Q so that the origin lies outside it. The length of tangent to the circle from the origin is equal to	(q)	0
(C)	If $y + b = m_1(x + a)$ and $y + b = m_2(x + a)$ are two tangents to $y^2 = 4ax$ then m_1m_2 is equal to	(r)	1
(D)	If the point (h, –1) is exterior to both the parabolas $y^2 = \|x\|$, then the integral value of h can be equal to	(s)	2
		(t)	5

Rough work

2. Given that $(x-2)^2+(y-2)^2=1$. Match the following column–I with column–II.

Column–I		Column–II	
(A)	Maximum value of $x+y$ is	(p)	$4+\sqrt{2}$
(B)	Maximum value of $x-y$ is	(q)	$\frac{9+4\sqrt{2}}{2}$
(C)	Maximum value of xy is	(r)	$\frac{4+\sqrt{7}}{3}$
(D)	Maximum value of $\frac{x}{y}$ is	(s)	$\sqrt{2}$
		(t)	$\sqrt{3}$

SECTION – C

Integer Answer Type

This section contains **6 questions.** The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

1. If the two points (0, 0) and (1, 1) does not lie on the same side of the line $a^2x + 2b(a + b + c)y + 4 = 0 \ \forall$ a, b $\in$ R then find the maximum value of c _____.

2. A curve is given by $f(x)=\sqrt{25-x^2}$. A line passing through the point (–6, –2) intersects the curve at exactly two points and the slope of such line is lying in [a, b) then the value of [a + b] (where [.] denotes the greatest integer function) is _____.

3. If x $\in$ [0, 4π] then the number of solutions of the equation $\sin^{-1}\left(\left|\log_6^2(\cos x)-1\right|\right)+\cos^{-1}\left(\left|3\log_6^2(\cos x)-7\right|\right)=\frac{\pi}{2}$ is _____.

4. Let S_k be the area bounded by the curve $y = x^2(1 - x)^k$ and the lines x = 0, y = 0 and x = 1. If $\lim\limits_{n\to\infty}\sum\limits_{k=1}^{n}S_k$ is equal to $\frac{p}{q}$ and p, q $\in$ N then find the least value of p + q _____.

5. If the quadratic equation $ax^2 + bx + c = 0$ has equal roots where a, b, c denotes the lengths of the sides opposite to vertex A, B, and C of the ΔABC respectively then find the number of integers in the range of $\frac{\sin A}{\sin C}+\frac{\sin C}{\sin A}$ _____

6. z_1, z_2 are the roots of quadratic equation $z^2 + az + b = 0$ (a, b are complex). If $|z_1+z_2|=|z_1|+|z_2|$ then there exists positive real number λ such that $a^2 = \lambda b$, whose minimum value is _____.

Rough work