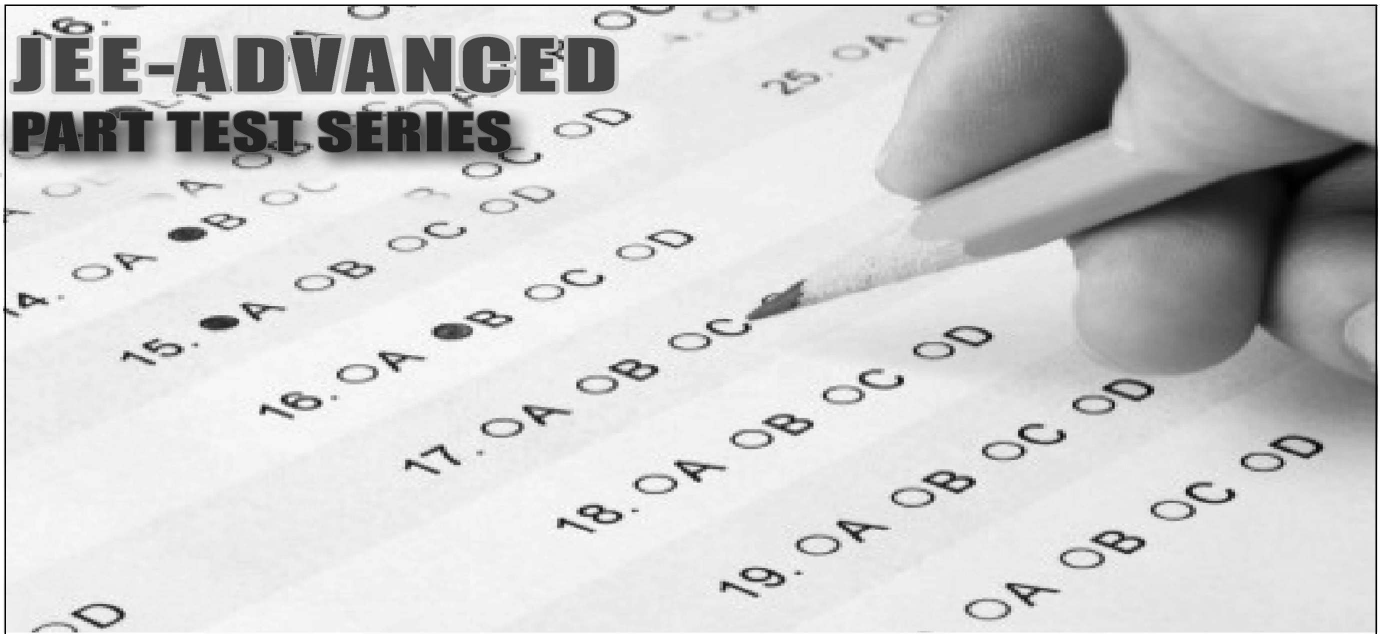


RPTA-10

Sri Chaitanya IIT Academy, India

A.P, TELANGANA, KARNATAKA, TAMILNADU, MAHARASHTRA, DELHI, RANCHI

A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR-HYD

Sec: Sr.IPLCO | **Dt: 01-11-15**

Time: 02:00 PM to 05:00 PM | **Max.Marks: 180**

Name of the Student: ___________________ **I.D. NO:**

PAPER-II

01-11-15_Sr.IPLCO_RPTA-10_Weekend Syllabus

MATHS:

Vectors: Addition of vectors, scalar multiplication, dot and cross products, scalar triple products and their geometrical interpretations.

Three Dimensions: Direction cosines and direction ratios, equation of a straight line in space, equation of a plane, distance of a point from a plane.

PHYSICS:

Electrostatics, Gauss law &Gravitation:

coulomb's law; electric field and potential; electrical potential energy of a system of point charges and of electrical dipoles in a uniform electrostatic field; electric field lines; flux of electric field; gauss's law and its application in simple cases, such as, to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell.

CHEMISTRY:

Group 17, Group 18, Metallurgy

JEE-ADVANCED-2014-P2-Model

Time: 2.00 PM to 5.00 PM **IMPORTANT INSTRUCTIONS** Max Marks: 180

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 10)	Questions with Single Correct Choice	3	-1	10	30
Sec – II(Q.N : 11 – 16)	Questions with Comprehension Type (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 17 – 20)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 30)	Questions with Single Correct Choice	3	-1	10	30
Sec – II(Q.N : 31 – 36)	Questions with Comprehension Type (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 37 – 40)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 50)	Questions with Single Correct Choice	3	-1	10	30
Sec – II(Q.N : 51 – 56)	Questions with Comprehension Type (3 Comprehensions – 2 +2+2 = 6Q)	3	-1	6	18
Sec – III(Q.N : 57 – 60)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

PART-I_PHYSICS Max Marks : 60

Section-1
(Only one Option correct Type)

This section contains 10 Multiple Choice questions. Each Question has Four choices (A), (B), (C) and (D). Out of Which **Only One is correct**

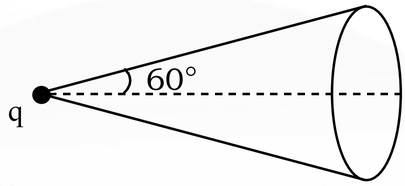
1. Inside a satellite orbiting very close to earth's surface, water does not fall out of a glass when it is inverted. Which of the following is the best explanation for above statement?

A) The earth does not exert any force on the water
B) The earth's force of attraction on the water is exactly balanced by the force created by satellites motion
C) The water & the glass have same acceleration towards the centre of the earth & hence there is no relative motion between them
D) The gravitational attraction between the glass & the water balances the earth's attraction on the water

2. An uncharged conductor A is brought near a positively charged conductor B. Then

A) the charge on B will increase but the potential of B will not change
B) the charge on B will not change but the potential of B will decrease
C) the charge on B will decrease but the potential of B will not change
D) the charge on B will not change but the potential of B will increase

3. A point charge 'q' is placed at the apex of a Gaussian conical surface of semi vertical angle 60^o. Which of the following statements is not true ?



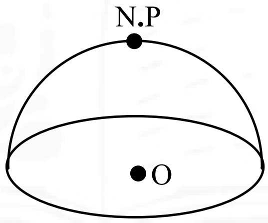
A) Electric flux magnitude through flat face of the cone is $\frac{q}{4\in_o}$

B) Electric flux magnitude through the entire conical Gaussian surface is $\frac{q}{4\in_o}$

C) Electric flux magnitude through the entire conical Gaussian surface is $\frac{q}{3\in_o}$

D) Electric flux magnitude function for the entire Gaussian surface is a discontinuous function, when 'q' is moved along the axis near the apex.

4. What is the potential difference between the north pole(NP) and the centre(O) of an inverted hemispherical conducting bowl of radius R carrying a uniform surface density ρ

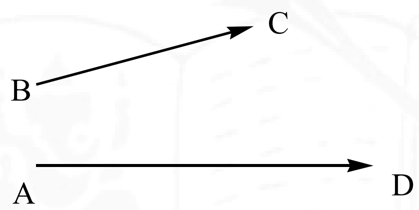


A) $\frac{\rho R}{2\in_o}$ B) $\frac{\rho R}{2\in_o}\left(\sqrt{2}-1\right)$ C) $\frac{\rho R^2}{2\in_o}$ D) $\sqrt{2}(\sqrt{2}-1)\frac{\rho R^2}{2\in_o}$

5. From a non-conducting sphere of uniform volume charge density and radius R, a spherical cavity of radius $R/4$ was made. Center of bigger sphere is origin (0,0,0) and cavity is $\left(\frac{R}{2},0,0\right)$. Electric field inside the cavity is $E_o\hat{i}$. What is electric flux linked with a Gaussian sphere of radius $3R/4$ centred at origin?

A) $\frac{21}{8}E_o\pi R^2$ B) $\frac{13}{4}E_o\pi R^2$ C) $\frac{63}{8}E_o\pi R^2$ D) $\frac{7}{8}E_o\pi R^2$

6. The figure shows electric field vectors at points A and B due to a point charge at origin. All points A,B,C,D are in xy plane. Co-ordinates of A,B,D are (3,0), (3,4) and (28,0) respectively. Length AD and BC represent the strength of these field vectors at A and B respectively. The coordinates of point C are

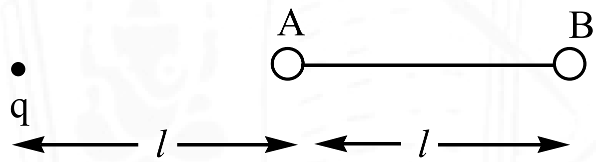


A) $\left(\frac{18}{5},\frac{24}{5}\right)$ B) $\left(\frac{42}{5},\frac{56}{5}\right)$ C) $\left(\frac{63}{5},\frac{84}{5}\right)$ D) $(18,24)$

7. The potential due to a conducting sphere of charge q at a point A outside the sphere is 7V and electric field there is $3V/m$. There is another point B such that the electric field at this point smaller in magnitude than that of 'A'. However, if magnitude of the charge is tripled, the electric field at B becomes 3V/m. The potential at B is now closest to (Assume potential at infinity is zero)

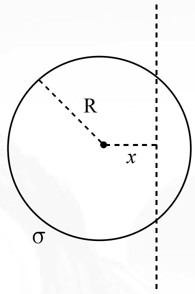
A) $21V$ B) $12V$ C) 7V D) $\frac{7}{3}V$

8. Two small neutral metal spheres A and B each of radius r supported on insulating stands located at a distance *l* from each other are connected by a thin conducting wire. Near to the spheres is brought a point charge q at a distance $\ell(\ell >> r)$ on the line joining centers of the spheres. The charge net induced on sphere B is



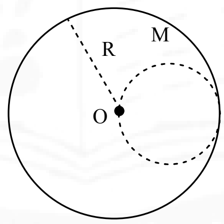
A) $\frac{qr}{2\ell}$ B) $\frac{qr}{4\ell}$ C) q D) $\frac{qr^2}{4\ell^2}$

9. A conducting sphere of radius R and surface charge density σ is given. An imaginary infinitely large plane surface at a distance 'x' from centre of sphere cuts the sphere as shown. What is the magnitude of the flux linked with one side of plane surface area due to electric field due to sphere $(0 < x < R)$



A) $\frac{\sigma}{2\in_o}$ B) $\frac{2\sigma\pi Rx}{\in_o}$ C) $\frac{\sigma 2\pi\left(R^2 - x^2\right)}{\in_o}$ D) $\frac{\sigma 2\pi x^2}{\in_o}$

10. Imagine a isolated uniform solid spherical rigid planet (ignore its rotation) of mass M and radius R. A smaller sphere of radius $\frac{R}{2}$ whose periphery coincides with centre of original planet can be scooped out as shown. If the scooped out portion somehow is slowly kept back in its place, then what is contact force between this scooped out portion and rest of the planet ?



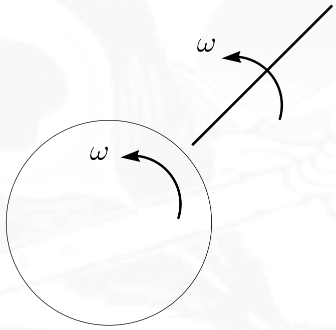
A) $\frac{GM^2}{16R^2}$ B) $\frac{GM^2}{8R^2}$ C) $\frac{GM^2}{4R^2}$ D) zero

Section-2
(Paragraph Type)

This section contains 3 paragraphs each describing theory, experiment, data etc. Six questions relate to three paragraphs with two questions on each paragraph. Each question pertaining to a particular **paragraph** should have only one correct answer among the four choices A, B, C and D.

Paragraph for Questions 11 & 12:

On a certain planet which is a uniform solid sphere of mass M and Radius R, due to rotation about its polar axis, ratio of maximum to minimum values of apparent acceleration due to gravity at the surface is 3 : 2



11. What is the length of a Geostationary satellite which is a vertical rigid rod with its one end suspended in air near earth's surface?

A) R B) $2(\sqrt{3}-1)R$ C) $(2-\sqrt{2})R$ D) $\frac{3R}{2}$

12. If the rod is suddenly stopped and released, then immediately after release (Just before collision with earth). What is the ratio of Tension in the rod at the points of trisection (closer point to earth to farther point to earth) ?

A) $\frac{3}{2}$ B) $\frac{2}{3}$ C) $\frac{5}{4}$ D) indeterminate

Paragraph for Questions 13 & 14:

The electric potential varies in space according to the relation V = 3x + 4y. A particle of mass 0.1 kg starts from rest from point (2, 3.2) under the influence of this field. The charge on the particle is +1μC. Assume V and (x, y) are in S.I. units

13. The component of electric field in the x-direction (E_x) is

A) $-3\,Vm^{-1}$ B) $4\,Vm^{-1}$ C) $5\,Vm^{-1}$ D) $8\,Vm^{-1}$

14. The velocity of the particle when it crosses the *x*-axis is

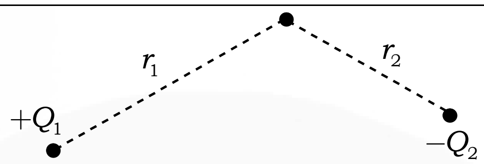
A) 20×10^{-3} ms^{-1} B) 40×10^{-3} ms^{-1}

C) 30×10^{-3} ms^{-1} D) 50×10^{-3} ms^{-1}

Paragraph for Questions 15 & 16:

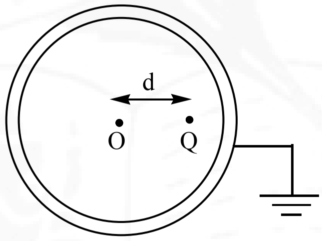
In order to investigate the interaction between a point charge and a conducting spherical shell, the method of spherical image charges can be applied. Firstly, we can consider a simple situation of two point charges $+Q_1$ and $-Q_2$ in space. In the field produced by them the locus of points of zero potential is given by

$$\frac{1}{4\pi\in_o}\left[\frac{Q_1}{r_1}-\frac{Q_2}{r_2}\right]=O$$



$\Rightarrow \frac{r_1}{r_2} =$ constant. According to Appollonios theorem, points with this property lie on a sphere called "Appollonios sphere". Therefore zero potential surface is a sphere.

If a spherical metal shell (of Radius R) is earthed (see diagram) and a point charge 'Q' is placed inside it at a distance 'd' from centre (d<R), electric field inside the shell (along with the points on the shell), due to the actual charge and induced charge will be as if it were produced by the actual charge Q and a negative point charge outside the spherical shell. The latter charge is what is called a "spherical image charge". The spherical shell, then can be considered the "Appollonios's sphere" mentioned above.



15. What is the force of interaction between grounded sphere and charge 'Q' mentioned in the paragraph? $(K = \frac{1}{4\pi \epsilon_o})$

A) $\frac{KQ^2Rd}{(R^2-d^2)^2}$ B) $\frac{KQ^2d}{R^3}$ C) $\frac{KQ^2d}{(R^2-d^2)^{3/2}}$ D) $\frac{KQ^2}{R^2-d^2}$

16. The value and location of image charge will be

A) "$\frac{-d}{R}Q$" to the right of Q and outside the sphere

B) "$\frac{-R}{d}Q$" to the right of Q and outside the sphere

C) "$\frac{-d}{R}Q$" to the left of Q and inside the sphere

D) "$\frac{-R}{d}Q$" to the left of Q and outside the sphere

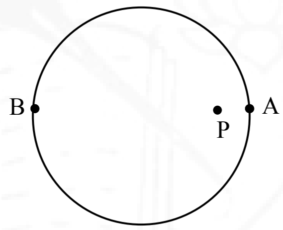
Section-3
(Matching List Type)

This section contains four questions, each having two matching lists (List-1 & List-II). The options for the **correct match** are provided as (A), (B),(C) and (D) out of which **ONLY ONE** is correct.

17. Column-II describes uniform mass distribution with points A,B marked on the material points of mass distribution and P is a space point where direction of gravitational field $\vec{E}$ is studied due to mass distribution in Column-I

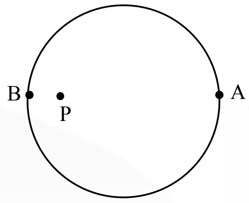
COLUMN-I **COLUMN-II**

A) $\vec{E}$ has a component towards A



P) Uniform circular ring. A,B are diametrically opposite points. P is on diameter AB, closer to A

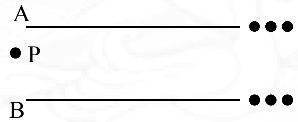
B) $\vec{E}$ is a null vector



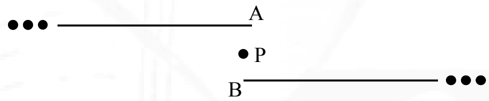
Axial view

Q) Uniform long hollow cylinder. APB is a line perpendicular to axis of cylinder passing through the axis and far away from its ends. P is closer to B

C) $\vec{E}$ has a component perpendicular to AB



R) A,B are ends of two identical uniform semi-infinite sheets. Line APB is perpendicular to sheets and P is midpoint of AB



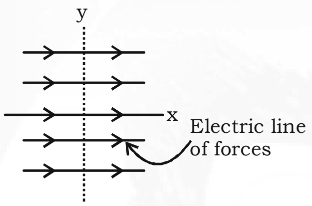
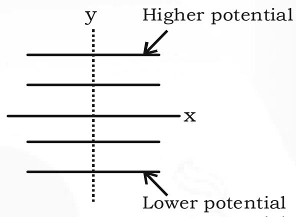
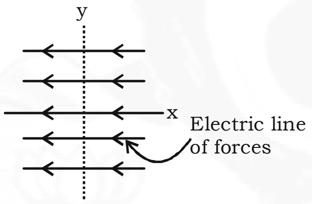
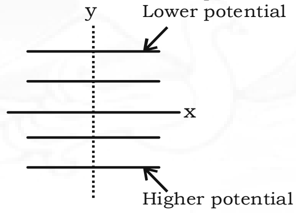
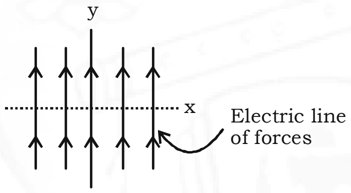
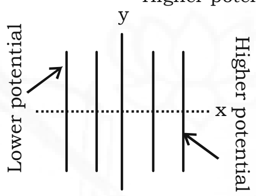
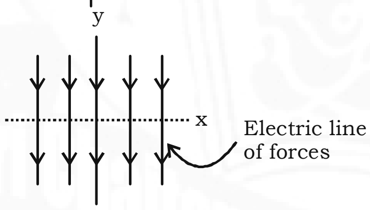
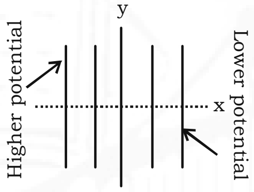
S) Similar description as option '**r**)' but the sheets' indeterminate ends are in opposite directions.

A) A- P ; B –Q,S ; C –R B) A- Q ; B –P,S ; C –R

C) A- P ; B –Q,R,S ; C –doesn't match

D) A- doesn't match ; B –Q,R,S ; C – doesn't match

18. Column I gives certain situation in which electric field is represented by electric lines of forces in x-y plane. Column II gives corresponding representation of equipotential lines in x-y plane. Match the figures in column I with the figures in column II

Column-I		***Column-II***	
P)		1)	
Q)		2)	
R)		3)	
S)		4)	

	P	Q	R	S		P	Q	R	S
A)	1	3	4	2	B)	2	4	3	1
C)	4	3	2	1	D)	3	1	4	2

19. In a free space, a thin rod (non-conducting) carrying uniformly distributed negative charge '-q' is placed symmetrically along the axis of a thin non-conducting ring of radius R carrying uniformly distributed charge Q. Mass of the rod is m and length is $\ell = 2R$. The ring is fixed and rod is free to move. The rod is displaced slightly along the axis of the ring by a small distance x (x<<R) and then released. Due to this displacement of rod by x from its symmetrically position the electrostatic potential energy of ring-rod system changes by δU. The restoring force on rod immediately after release is F. The time period of small oscillations of rod is T.

Column-I	Column-II
(i) δU for fixed values of $Q, -q, R$ is proportional to x^n where n=	(p) 2
(ii) F for fixed values of Q,-q,R is proportional to x^r where r=	(q) 1
(iii) $\frac{\delta U}{x^n}$ (where n as mentioned in option i) is $\frac{Qq}{K4\sqrt{2}\pi \in_o R^3}$ where K=	(r) $\frac{3}{2}$
(iv) T for fixed values of $Q, -q, m$ is proportional to R^p where p=	(s) 3

A) i – p; ii – q; iii – p; iv – r B) i – p; ii – q; iii – q; iv – r

C) i – p; ii – q; iii – r; iv – s D) i – p; ii – p; iii – p; iv - r

20. If a charge q is spread uniformly on a thin non-conducting square sheet, the electric potential at its centre and corner are found to be v_1 and v_2 respectively. If six such charged sheets are joined to make a hollow cube, the potential at the centre of the cube is found be v_3. The potential at corner of this cube is v_4. In all cases potential at infinitely distant points is assumed to be zero

Column – I	**Column – II**
(A) $\frac{v_1}{v_2}=$	(P) -1
(B) The number of points in the plane of the isolated charged sheet mentioned above having potential of v_2 is	(Q) 4
(C) $v_4 = 3v_2 + \frac{v_3}{n}$ where n=	(R) 2
(D) Instead of potential at infinity, potential at centre of isolated charged sheet mentioned above is taken as zero, then ratio of new value of v_2 to old value of v_2 is	(S) $\frac{1}{2}$

A) A-P, B-S, C-R, D-Q
B) A-R, B-Q, C-R, D-P
C) A-S, B-Q, C-R, D-P
D) A-R, B-Q, C-Q, D-P

PART-II_CHEMISTRY Max Marks : 60

Section-1
(One or more options correct type)

This section contains 10 Multiple Choice questions. Each Question has Four choices (A), (B), (C) and (D). Out of Which **Only One is correct**

21. $HClO_4 + P_4O_{10} \rightarrow A + B$. In 'A', the number of $d_\pi - p_\pi$ bonds are

A) 8 B) 4 C) 6 D) 7

22. $'p' \, Au + qCN^- + H_2O + O_2 \rightarrow X + OH^-$. In the balanced stoichiometric equation the 'q' value is

A) 8 B) 4 C) 2 D) 6

23. $KI + I_2 \rightleftharpoons KX$. The true statement regarding the anion 'X' is

A) It has bent structure

B) The central iodine atom has sp^3 hybridization

C) It has one $d_\pi - p_\pi$ bond

D) It has 9 lone-pairs

24. Which of the following is oxidized by Conc. H_2SO_4 ?

A) HF B) HCl C) HI D) H_2F_2

25. The number of $d_\pi - p_\pi$ bonds in perxenate ion is

A) 4 B) 6 C) 8 D) 2

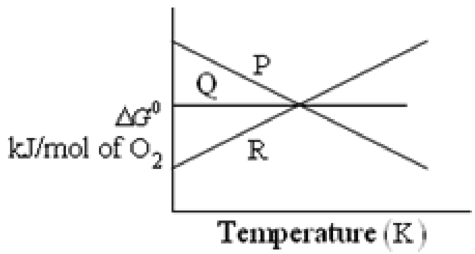
26. Which one of the following is not a carbonate mineral?

A) Cerrusite B) Anglesite C) Calamine D) Aragonite

27. (I) $C(s)+O_2(g)\rightarrow CO_2(g)$

(II) $2CO(g)+O_2(g)\rightarrow 2CO_2(g)$

(III) $2C+O_2(g)\rightarrow 2CO(g)$



Match the graph with the above process

A) P-I, Q-II, R-III B) P-II, Q-I, R-III

C) P-III, Q-I,R-II D) P-III, Q-II, R-I

28. The usual carbon content in steel is

A) 2 – 6% B) 2 – 0.2% C) 0.1 – 1% D) 0 – 6%

29. The chief slag formed in the Blast furnace during the extraction of iron is

A) $FeSiO_3$ B) $MgSiO_3$ C) $Ca_3(PO_4)_2$ D) $CaSiO_3$

30. The slag formed during the Bessemer process in the extraction of copper is

A) $FeSiO_3$ B) $MgSiO_3$ C) $Ca_3(PO_4)_2$ D) $CaSiO_3$

Section-2
(Paragraph Type)

This section contains 3 paragraphs each describing theory, experiment, data etc. Six questions relate to three paragraphs with two questions on each paragraph. Each question pertaining to a particular **paragraph** should have only one correct answer among the four choices A, B, C and D.

Paragraph for Questions 31 and 32

$$FeO.Cr_2O_3 \xrightarrow[\Delta]{Na_2CO_3} Mass \xrightarrow[\text{evaporated, crystallized}]{\text{leached with water,}} P(\text{yellow compound})$$

Blast of air

$$P \xrightarrow{Conc.H_2SO_4} \underset{(\text{orange red})}{Q} + Na_2SO_4.10H_2O \left(\begin{array}{l}\text{crystalized and}\\ \text{separated by filtration}\end{array}\right)$$

$$\underset{(\text{orange red})}{NaCl + R} \xleftarrow{NH_4Cl} Q$$

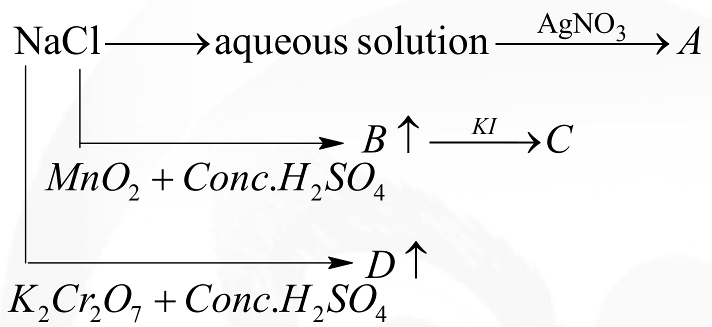
31. $R \xrightarrow[\Delta]{} A + B\uparrow + H_2O$. $'A'$ and $'B'$ are

A) Cr and N_2 B) Cr_2O_3 and N_2 C) Cr and NH_3 D) Cr_2O_3 and NH_3

32. 'A' can be best reduced to metal by using

A) H_2 B) C C) Al D) Mg

Paragraph for Question 33 and 34



33. The number of $d_{\pi} - p_{\pi}$ bonds in 'D' is

A)1 B)2 C)3 D) 4

34. The correct statement regarding A or B or C is

A) B gives blue color with starch

B) B does not react with water

C) A is insoluble in aqueous ammonia

D) C is soluble in aqueous KI

Paragraph for Question 35 and 36

(i) Cl_2 reacts with water giving $Cl_2 + H_2O \rightarrow HClO + HCl$

(ii) $2CuCl_2 \xrightarrow[\Delta]{} 2CuCl + Cl_2$

35. Which one of the following can behave like Cl_2 ?

A) O_2 B) N_2 C) CO_2 D) $(CN)_2$

36. $Cu(CN)_2 \xrightarrow[\Delta]{} A + B\uparrow$

$CuI_2 \xrightarrow[\Delta]{} C + D$

B & D are respectively

A) $CuCN, CuI$ B) $CuI, CuCN$

C) $I_2, (CN)_2$ D) $(CN)_2, I_2$

Section-3
(Matching List Type)

This section contains four questions, each having two matching lists (List-1 & List-II). The options for the **correct match** are provided as (A), (B),(C) and (D) out of which **ONLY ONE** is correct.

37. Match the column:

Column-I		Column-II	
P)	ClO^-	**1)**	Weakest base
Q)	ClO_2^-	**2)**	Present of $d_\pi - p_\pi$ bonds
R)	ClO_3^-	**3)**	Highest charge density on oxygen
S)	ClO_4^-	**4)**	Least delocalization of π-electrons

Code :

	P	Q	R	S
A)	3,4	2	2	1,2
B)	3	1,2	3	1,3
C)	4	1,3	2,3	2
D)	1,2	2,3	3,4	1,3

38. Match the element given in column-I with the property related to it given in column-II

Column-I		***Column-II***	
P)	Cl_2	**1)**	Forms stable Gas Hydrate
Q)	Xe	**2)**	Colored substance
R)	I_2	**3)**	Oxidizing agent
S)	F_2	**4)**	Least reactive

	P	**Q**	**R**	**S**
A)	1,3,4	2,4	2,3	1,4
B)	1,2,3	1,4	2,3	2,3
C)	1,4	2,3	2,4	1,2
D)	1,3	1,2	1,3	1,3

39. Match the metal given in column-I with the process related directly for the extraction of metal or for the extraction of other metal

Column-I		***Column-II***	
P)	Pb	**1)**	Parkes process
Q)	Ag	**2)**	Pattinsons process
R)	Zn	**3)**	Mc Arthur Forrest cyanide process
S)	Au	**4)**	Electrorefining

	P	**Q**	**R**	**S**
A)	1,2,3	1,3,4	1,2,4	2,3
B)	1,3	3,4	1,2	1,3
C)	3,4	2,3	1,4	3,4
D)	1,2,4	1,2,3,4	1,3,4	3,4

40. Match the product/s given in column-II with the reactive given in column-I

	Column-I		*Column-II*
P)	$ClO_2 + NaOH$	**1)**	$NaClO_2$
Q)	$Cl_2O_6 + NaOH$	**2)**	$NaClO_3$
R)	$Cl_2O + NaOH(\text{cold})$	**3)**	$NaClO_4$
S)	$ClO_2 + NaOH + H_2O_2$	**4)**	$NaClO$

	P	**Q**	**R**	**S**		**P**	**Q**	**R**	**S**
A)	1,2	2,3	4	1	B)	2,3	1,3	1	4
C)	3	2	1	3	D)	1	2	3	4

PART-III_MATHEMATICS Max Marks : 60

Section-1
(Only one Option correct Type)

This section contains 10 Multiple Choice questions. Each Question has Four choices (A), (B), (C) and (D). Out of Which **Only One is correct**

41. Let $\overline{a},\overline{b},\overline{c}$ be three vectors given by $\overline{a}=i+j+2k,\overline{b}=2i+j-k,\overline{c}=5i+3j$ and if $\overline{r}$ is a unit vector then the maximum possible value of $\left\|\left[\overline{r}\,\overline{a}\,\overline{b}\right]\right\|+\left\|\left[\overline{r}\,\overline{b}\,\overline{c}\right]\right\|$ equals

A) $2\sqrt{35}$ B) $3\sqrt{7}$ C) $5\sqrt{7}$ D) $10\sqrt{7}$

42. If $\overline{a}+\overline{b}+\overline{c}=\overline{p},\overline{a}\times\overline{b}=\overline{q},\overline{b}\times\overline{c}=\overline{r},\overline{a}.\overline{p}=1,\overline{b}.\overline{p}=1$ and $|\overline{p}|^2=3$ then which is false

A) $\overline{a}=\frac{1}{3}\left(\overline{p}+2\overline{p}\times\overline{q}+\overline{p}\times\overline{r}\right)$ B) $\overline{b}=\frac{1}{3}\left(\overline{p}+\overline{p}\times\overline{q}+\overline{p}\times\overline{r}\right)$

C) $\overline{p}\times\overline{q}=\overline{a}-\overline{b}$ D) $\left[\overline{a}\,\overline{b}\,\overline{c}\right]=\left[\overline{p}\,\overline{q}\,\overline{r}\right]$

43. Let $\overline{a},\overline{b},\overline{c}$ be unit vectors and are non-coplanar such that $\left[\overline{a}\times\left(\overline{b}\times\overline{c}\right)\;2\overline{b}\times\left(\overline{c}\times\overline{a}\right)\;3\overline{c}\times\left(\overline{a}\times\overline{b}\right)\right]=\left(\lambda^3-\lambda\right)\left[\overline{a}\,\overline{b}\,\overline{c}\right],\lambda$ is real, then number of possible values of λ

A) 0 B) 1 C) 2 D) 3

44. If A, B,C,D are four points in space and satisfying $\left|\overrightarrow{AB}\right|=3,\left|\overrightarrow{BC}\right|=7,\left|\overrightarrow{CD}\right|=11$ and $\left|\overrightarrow{DA}\right|=9$ then the value of $\overrightarrow{AC}.\overrightarrow{BD}$

A) 0 B) 21 C) 15 D) 27

45. If the vectors $-\bar{i}+c\bar{j}+b\bar{k},c\bar{i}-\bar{j}+a\bar{k},b\bar{i}+a\bar{j}-\bar{k}$ are coplanar vectors and $|a|\le 1$ then the maximum value of $\left|a\bar{i}+b\bar{j}+c\bar{k}\right|^2$ is

A) 3 B) 12 C) 18 D) 8

46. The resultant of the two vectors $\bar{a}$ and $\bar{b}$ is $\bar{c}$. If $\bar{c}$ trisects the angle between $\bar{a}$ and $\bar{b}$ and if $|\bar{a}|=6,\left|\bar{b}\right|=4$ then $|\bar{c}|$ equals (no two vectors are parallel)

A) 3 B) 4 C) 5 D) 6

47. If the vector $\bar{r}$ satisfies $\bar{r}\times\bar{a}+\left(\bar{r}.\bar{b}\right)\bar{c}=\bar{d}$ be given by $\bar{r}=\lambda\bar{a}+\bar{a}\times\dfrac{\bar{a}\times\left(\bar{d}\times\bar{c}\right)}{(\bar{a}.\bar{c})|\bar{a}|^2}$ then $\lambda=$($\bar{a},\bar{b},\bar{c},\bar{d}$ are non – zero vectors and $\bar{a}$ is not perpendicular to $\bar{c}$)

A) $\dfrac{\bar{a}.\bar{c}}{|\bar{a}|^2}$ B) $\dfrac{\bar{a}.\bar{b}}{|\bar{a}|^2}$ C) $\dfrac{\bar{c}.\bar{d}}{|\bar{a}|^2}$ D) $\dfrac{\bar{r}.\bar{a}}{|\bar{a}|^2}$

48. The plane which contains the line $3x+y=1, z=4$ and parallel to the line $x+y+z+1=0, y+2z=1$ cuts the x, y, z axes respectively at $(\alpha,0,0),(0,\beta,0),(0,0,\gamma)$ then $\alpha^2+\beta^2+\gamma^2$ equals

A) 10 B) 14 C) 19 D) 21

49. Given a tetrahedran ABCD with AB=12, CD=6,. If the shortest distance between the skew lines AB and CD is 8 and the angle between them is $\frac{\pi}{6}$ then the volume of tetrahedran is

A) 12 B) 36 C) 48 D) 72

50. If $\overline{x}$ and $\overline{y}$ be two unit vectors inclined at an angle 60^0 so that $\overline{x}+\overline{y}=\overline{a}$ and $\overline{x}\times\overline{y}=\overline{b}$ such that $\overline{x}=\alpha\overline{a}+\beta\left(\overline{a}\times\overline{b}\right)$ then the value of $\frac{1}{\beta}+2\alpha$ is

A) 1 B) 2 C) 4 D) 5

Section-2
(Paragraph Type)

This section contains 3 paragraphs each describing theory, experiment, data etc. Six questions relate to three paragraphs with two questions on each paragraph. Each question pertaining to a particular paragraph should have **only one correct answer** among the four choices A, B, C and D.

Paragraph for Questions 51 & 52

A plane P contains the line $L_1 : \frac{y}{b}+\frac{z}{c}=1, x=0$ and is parallel to the line $L_2 : \frac{x}{a}-\frac{z}{c}=1, y=0$ then

51. Equation of the plane P is

A) $\frac{x}{a}-\frac{y}{b}+\frac{z}{c}+1=0$ B) $\frac{x}{a}-\frac{y}{b}-\frac{z}{c}+1=0$

C) $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}+1=0$ D) $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}-1=0$

52. If the shortest distance between the lines L_1 and L_2 is ¼ then the shortest distance from origin to the plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$ is

A) ¼ B) ½ C) 1 D) 1/8

Paragraph For Questions 53 & 54

If the three lines $L_1 : x = y = z, L_2 : x = \frac{y}{2} = \frac{z}{3}, L_3 : \frac{x-1}{a} = \frac{y-1}{b} = \frac{z-1}{c}$ from a triangle of area $\sqrt{6}$ square units

53. If (α, β, γ) is the point of intersection of L_2 and L_3 then $|\alpha + \beta + \gamma|$ equals

A) 4 B) 6 C) 0 D) 12

54. The possible acute angle between L_2 and L_3 is

A) $\frac{\pi}{3}$ B) $\frac{\pi}{6}$ C) $\cos^{-1}\left(\frac{22}{7\sqrt{10}}\right)$ D) $\frac{\pi}{2}$

Paragraph For Questions 55 & 56

The line of greatest slope on an inclined plane P_1 is the line in the plane P_1 which is perpendicular to the line of intersection of the plane P_1 and a horizontal plane P_2

55. Assuming the plane $2x - 3y + 4z = 0$ to be horizontal, the direction cosines of the line of greatest slope in the plane $x - 2y + 3z = 0$ are

A) $\frac{4}{\sqrt{21}}, \frac{-1}{\sqrt{21}}, \frac{-2}{\sqrt{21}}$ B) $\frac{4}{\sqrt{21}}, \frac{1}{\sqrt{21}}, \frac{-2}{\sqrt{21}}$ C) $\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}$ D) $\frac{4}{\sqrt{21}}, \frac{2}{\sqrt{21}}, \frac{-1}{\sqrt{21}}$

56. The coordinates of a point on the plane $2x+y-5z=0$ which is $2\sqrt{11}$ units away from the line of intersection of $2x+y-5z=0$ and $4x-3y+7z=0$ are

A) $(6,2,-2)$ B) $(3,1,-1)$ C) $(6,-2,2)$ D) $(1,3,-1)$

Section-3
(Matching List Type)

This section contains four questions, each having two matching lists (List-1 & List-II). The options for the **correct match** are provided as (A), (B),(C) and (D) out of which **ONLY ONE** is correct.

57. Match the following

	COLUMN – I	COLUMN – II
(A)	A line perpendicular to $x+2y+2z=0$ and passes through $(0,1,0)$. The perpendicular distance of this line from origin is k then $[k]$ equals ([] is GIF)	(p) 3
(B)	The value of λ for which the plane $x-y+z+1=0$, $\lambda x+3y+2z-3=0, 3x+\lambda y+z-2=0$ from a triangular prism is	(q) 2
(C)	If the circumcentre of the triangle whose vertices are $(3,2,-5),(-3,8,-5)$ and $(-3,2,1)$ is $(-1,\lambda,-3)$ then λ equals	(r) 4
(D)	If the four planes $my+nz=0, nz+lx=0, lx+my=0$ and $lx+my+nz=p$ from a tetrahedran whose volume is $\frac{\lambda p^3}{3lmn}$ then λ equals	(s) 0

A) A–s, B–r, C–r, D–q B) A–s, B–p, C–r, D–q

C) A–p, B–q, C–r, D–s D) A–p, B–r, C–s, D–q

58. Let $L_1 : x + y + z - 4 = 0 = 2x - y + z - 3,\ L_2 : 3x - y + z - 4 = 0 = \lambda x - z + 3$

	COLUMN – I	COLUMN – II
(A)	L_1, L_2 are coplanar then λ equals	(p) 2
(B)	If $((\alpha, \beta, \gamma)$ lies on both L_1 and L_2 then $\alpha - \beta + 3\gamma$ equals	(q) 1
(C)	If L_1 is parallel to the plane $x + y + pz - 7 = 0$ then p equals	(r) 6
(D)	If L_1, L_2 are coplanar and if acute angle between L_1, L_2 is $\cos^{-1}\left(\frac{\sqrt{7}}{k\sqrt{3}}\right)$ then k equals	(s) -1

A) A–s, B–r, C–q, D–p B) A–s, B–p, C–q, D–r

C) A–s, B–q, C–p, D–r D) A–s, B–p, C–r, D–q

59. Match the following

	COLUMN – I		COLUMN – II
(A)	If $\vec{a}+\vec{b}=\hat{j}$ and $2\vec{a}-\vec{b}=3\hat{i}+\frac{\hat{j}}{2}$, then cosine of the angle between $\vec{a}$ and $\vec{b}$ is	(p)	1
(B)	If $\lvert\vec{a}\rvert=\lvert\vec{b}\rvert=\lvert\vec{c}\rvert$, angle between each pair of vectors is $\frac{\pi}{3}$ and $\lvert\vec{a}+\vec{b}+\vec{c}\rvert=\sqrt{6}$, then $\lvert\vec{a}\rvert=$	(q)	$5\sqrt{3}$
(C)	Area of the parallelogram whose diagonals represent the vectors $3\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+4\hat{k}$ is	(r)	7
(D)	If $\vec{a}$ is perpendicular to $\vec{b}+\vec{c}$, $\vec{b}$ is perpendicular to $\vec{c}+\vec{a}$, $\vec{c}$ is perpendicular to $\vec{a}+\vec{b}$, $\lvert\vec{a}\rvert=2$, $\lvert\vec{b}\rvert=3$ and $\lvert\vec{c}\rvert=6$ then $\lvert\vec{a}+\vec{b}+\vec{c}\rvert$ is	(s)	$\frac{-3}{5}$

A) A–s, B–p, C–q, D–r
B) A–s, B–q, C–p, D–r
C) A–s, B–r, C–p, D–q
D) A–r, B–q, C–p, D–s

60.

	COLUMN – I		COLUMN – II
(A)	The line $\vec{r}=\left(\hat{i}+\hat{j}\right)+t\left(\hat{i}-\hat{k}\right)$ where $'t'$ is scalar passes through the point	(p)	$-\hat{i}-\hat{j}+2\hat{k}$
(B)	The line $\vec{r}=\left(\hat{i}+\hat{j}\right)+t\left(\hat{i}-\hat{k}\right)$ where $'t'$ is scalar and the plane $\vec{r}.\left(2\hat{i}+\hat{j}+\hat{k}\right)=2$ intersect at the point	(q)	$-\hat{i}+\hat{j}+2\hat{k}$
(C)	The point on the line $\vec{r}=\left(\hat{i}+\hat{j}\right)+t\left(\hat{i}-\hat{k}\right)$ where $'t'$ is scalar, which is at a distance of 3 units from the point having position vector $\hat{i}$ is/are	(r)	$-2\hat{i}+\hat{j}+3\hat{k}$
(D)	The volume of the parallelepiped having adjacent sides $\hat{i}+\hat{k}, 2\hat{i}+\hat{j}+\hat{k}$ and $\vec{c}$ is 4 cubic units then $\vec{c}$ may be	(s)	$\hat{j}+\hat{k}$

A) A–qrs, B–s, C–q, D–q
B) A–qrs, B–q, C–s, D–q
C) A–qrs, B–p, C–s, D–r
D) A–qrs, B–prs, C–qs, D–q