

**IITJEE 2008 Chemistry**

**Paper 2 Code 2**

**SECTION – I**

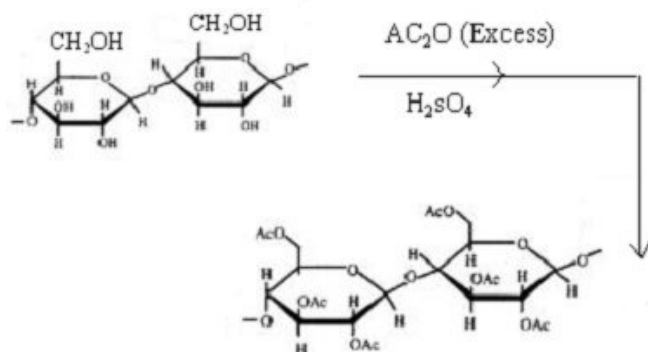
**Straight Objective Type**

This section contains 6 multiple choice questions. Each question has 4 choices( A), (B) , (C) , (D) out of which **ONLY ONE** is correct

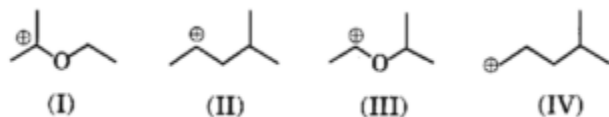
45. Cellulose upon acetylation with excess acetic anhydride/  $H_2SO_4$  (catalytic) gives cellulose triacetate whose structure is

- (A)
- (B)
- (C)
- (D)

**Solution:**

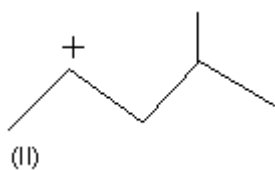


46. The correct stability order for the following species is

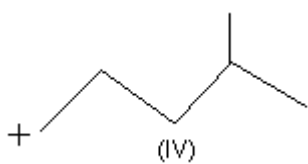


- (A)            (II) > (IV) > (I) > (III)  
 (B)            (I) > (II) > (III) > (IV)  
 (C)            (II) > (I) > (IV) > (III)  
 (D)            (I) > (III) > (II) > (IV)

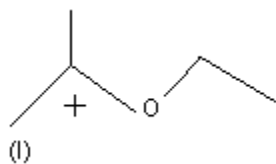
**Solution:** (C)



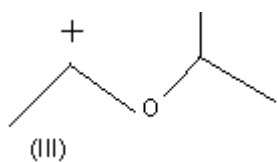
Most stable as it has 5 H for hyper conjugation



2 H available for hyper conjugation.



It has 6 H for hyper conjugation but oxygen being EWG destabilizes carbonation.

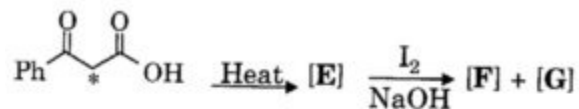


(oxygen).

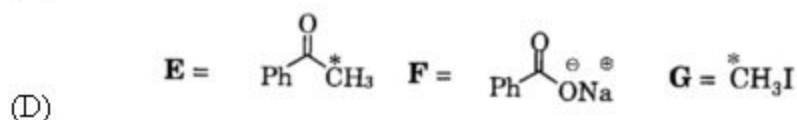
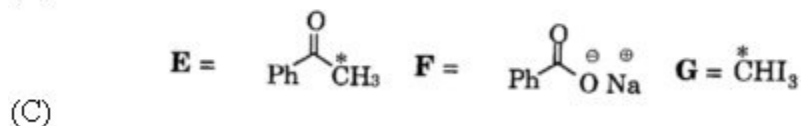
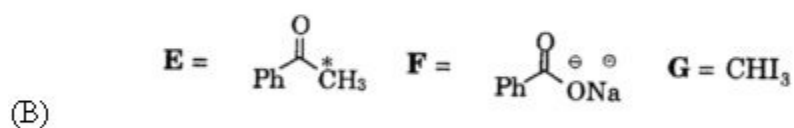
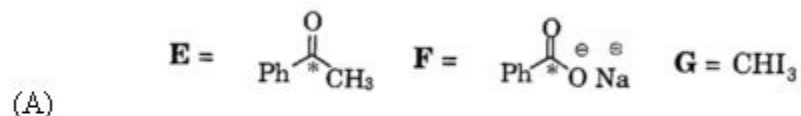
It is least stable as it has only 3 H for hyper conjugation as well as EWG

47.

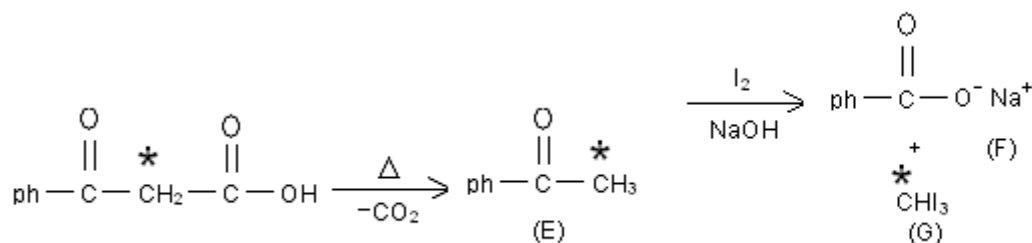
In the following reaction sequence, the correct structures of E, F and G are



(\* implies  $^{13}\text{C}$  labeled carbon)



**Solution: (C)**



48. Among the following, the surfactant that will form micelles in aqueous solution at the lowest molar concentration at ambient condition is

- $\text{CH}_3(\text{CH}_2)_{15}\text{N}^+(\text{CH}_3)_3\text{Br}^-$
- $\text{CH}_3(\text{CH}_2)_{11}\text{OSO}_3^- \text{Na}^+$
- $\text{CH}_3(\text{CH}_2)_{11}\text{OSO}_3^- \text{Na}^+$
- $\text{CH}_3(\text{CH}_2)_6\text{COO}^- \text{Na}^+$
- (E)  $\text{CH}_3(\text{CH}_2)_{11}\text{N}^+(\text{CH}_3)_3\text{Br}$

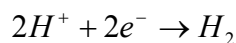
**Solution: (A)**

CMC is lowest for surfactants having higher/longer hydrocarbon chains (which increases the tendency of the surfactant molecule to associate)

**49.** Electrolysis of dilute aqueous NaCl solution was carried out by passing 10 milli ampere current. The time required to liberate 0.01 mol of  $H_2$  gas at the cathode is (1 Faraday =  $96500 \text{ C mol}^{-1}$ )

- (A)  $9.65 \times 10^4 \text{ sec}$                       (B)  $19.3 \times 10^4 \text{ sec}$   
(C)  $28.95 \times 10^4 \text{ sec}$                       (D)  $38.6 \times 10^4 \text{ sec}$

**Solution: (B)**



$$2F \equiv 1 \text{ mole}$$

$$\Rightarrow 1 \text{ mole} \equiv 2F$$



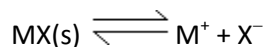
$$\Rightarrow 0.01 \text{ mol } H_2 \equiv 0.001 \times 0.02F = \frac{It}{96500} \quad \Rightarrow (I = 10 \times 10^{-3})$$

$$\Rightarrow t = 19.3 \times 10^4$$

**50.** Solubility product constants ( $K_{sp}$ ) of salts of types MX,  $MX_2$  and  $M_3X$  at temperature "T" are  $4.0 \times 10^{-8}$ ,  $3.2 \times 10^{-14}$  and  $2.7 \times 10^{-15}$  respectively. Solubilities ( $\text{mol dm}^{-3}$ ) of the salts at temperature "T" are in the order

- (A)  $MX > MX_2 > M_3X$                       (B)  $M_3X > MX_2 > MX$   
(C)  $MX_2 > M_3X > MX$                       (D)  $MX > M_3X > MX_2$

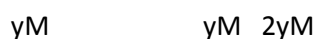
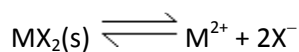
**Solution: (D)**



$$xM \quad xM \quad xM$$

$$\Rightarrow K_{sp1} = [M^+] [X^-] = x^2$$

$$\Rightarrow x = \sqrt{K_{sp1}} = 2 \times 10^{-4} \text{ m}$$

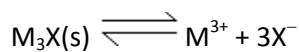


$$\Rightarrow k_{sp2} = [\text{M}^{2+}] [\text{X}^-]^2$$

$$= y \cdot (2y)^2$$

$$\Rightarrow y = \sqrt{\frac{k_{sp2}}{4}}$$

$$= 2 \times 10^{-4} \text{ M}$$

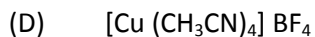
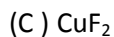
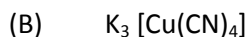
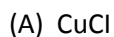


$$\Rightarrow k_{sp3} = [\text{M}^{3+}] [\text{X}^-]^3 = z \cdot (3z)^3$$

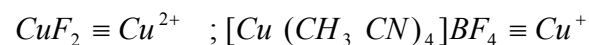
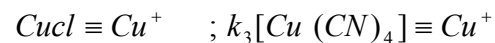
$$\Rightarrow z = \sqrt[3]{\frac{k_{sp3}}{27}} = 10^{-4} \text{ M}$$

$$\Rightarrow \text{MX} > \text{M}_3\text{X} > \text{MX}_2$$

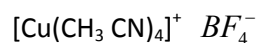
51. Among the following, the coloured compound is



**Solution:** (C)



|||

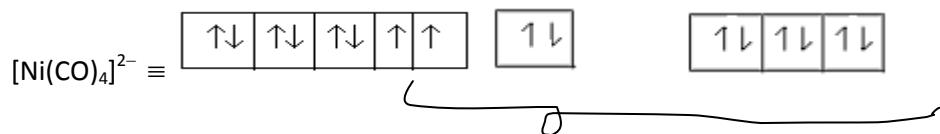


$\text{Cu}^+ : [\text{Ar}] 3d^{10} \equiv$  No electron transition possible (Diamagnetic)  $\text{Cu}^{2+} : [\text{Ar}] 3d^9 \equiv$  Paramagnetic

52. The IUPAC name of  $[\text{Ni}(\text{NH}_3)_4] [\text{NiCl}_4]$  is







4 (CO) ligands donate  $4e^-$  pairs in these orbitals.

=>  $dsp^2$  hybridization

## SECTION - II

### Reasoning Type

This section contains 4 reasoning type questions. Each question has 4 choices

(A) , (B) , (C) , (D) , out of which **ONLY ONE** is correct

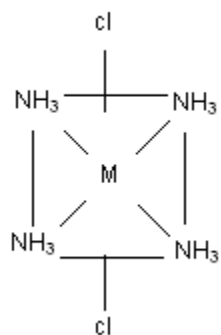
54. STATEMENT-1 : The geometrical isomers of the complex  $[\text{M}(\text{NH}_3)_4\text{Cl}_2]$  are optically inactive.

And

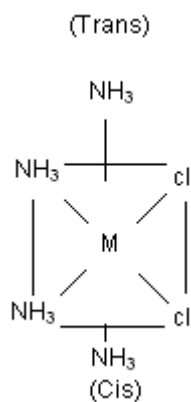
STATEMENT-2 : Both geometrical isomers of the complex  $[\text{M}(\text{NH}_3)_4\text{Cl}_2]$  possess axis of symmetry.

- (A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
- (B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is **NOT** a correct explanation for STATEMENT-1
- (C) STATEMENT-1 is True, STATEMENT-2 is False
- (D) STATEMENT-1 is False, STATEMENT-2 is True

**Solution:** (A)



Trans isomer : Optically inactive as it has a plane of symmetry.



Cis Isomer : It also has a plane of symmetry. So, it is optically inactive

55. STATEMENT-1 : There is a natural asymmetry between converting work to heat and converting heat to work.

**And**

STATEMENT-2: No process is possible in which the sole result is the absorption of heat from a reservoir and its complete conversion into work.

- (A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
- (B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is **NOT** a correct explanation for STATEMENT-1
- (C) STATEMENT-1 is True, STATEMENT-2 is False
- (D) STATEMENT-1 is False, STATEMENT-2 is True

**Solution:** (A)

2<sup>nd</sup> law of thermodynamics : Heat cannot be Converted to work with 100% efficiency but the reverse is not true

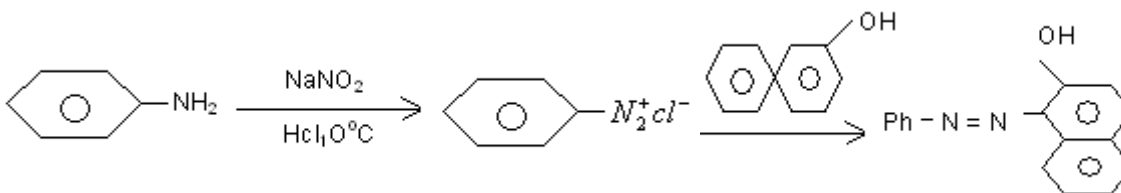
56. STATEMENT-1: Aniline on reaction with  $\text{NaNO}_2 / \text{HCl}$  at  $0^\circ\text{C}$  followed by coupling with  $\beta$  - naphthol gives a dark blue colored precipitate.

**And**

STATEMENT-2: The colour of the compound formed in the reaction of aniline with  $\text{NaNO}_2 / \text{HCl}$  at  $0^\circ\text{C}$  followed by coupling with  $\beta$ -naphthol is due to the extended conjugation.

- (A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
- (B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is **NOT** a correct explanation for STATEMENT-1
- (C) STATEMENT-1 is True, STATEMENT-2 is False
- (D) STATEMENT-1 is False, STATEMENT-2 is True

**Solution:** (D)



Orange Dye

Statement is False.

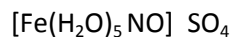
57. STATEMENT-1:  $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$  is paramagnetic.

**And**

STATEMENT-2: The Fe in  $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$  has three unpaired electrons.

- (A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
- (B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is **NOT** a correct explanation for STATEMENT-1
- (C) STATEMENT-1 is True, STATEMENT-2 is False
- (D) STATEMENT-1 is False, STATEMENT-2 is True

**Solution: (A)**



No has a tive charge on it ( $\text{NO}^+ \equiv \text{Nitrosonium}$ )

=> Oxidation state of Fe is +1 =  $\text{Fe}^+ \equiv [\text{Ar}] 3d^6 4s^1$ 

↑↓	↑↓	↑	↑	↑	
----	----	---	---	---	--

 => 3 unpaired  $e^-$ s  
(Paramagnetic)

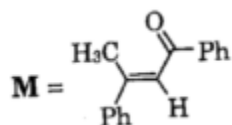
### SECTION - III

#### Linked Comprehension Type

This section contains 3 paragraphs. Based upon each paragraph , 3 multiple choice questions have to be answered. Each question has 4 choices (A) , (B) , (C) ,(D) ,out of which **ONLY ONE** is correct .

#### Paragraph for Question Nos. 58 to 60

A tertiary alcohol **H** upon acid catalysed dehydration gives a product **I**. Ozonolysis of **I** leads to compounds **J** and **K**. Compound **J** upon reaction with KOH gives benzyl alcohol and a compound **L**, whereas **K** on reaction with KOH gives only **M**.



58. Compound **H** is formed by the reaction of

- a.  $\begin{array}{c} \text{O} \\ \parallel \\ \text{Ph} \quad \text{CH}_3 \end{array} + \text{PhMgBr}$
- b.  $\begin{array}{c} \text{O} \\ \parallel \\ \text{Ph} \quad \text{CH}_3 \end{array} + \text{PhCH}_2\text{MgBr}$
- c.  $\begin{array}{c} \text{O} \\ \parallel \\ \text{Ph} \quad \text{H} \end{array} + \text{PhCH}_2\text{MgBr}$
- d.  $\begin{array}{c} \text{O} \\ \parallel \\ \text{Ph} \quad \text{H} \end{array} + \begin{array}{c} \text{Me} \\ | \\ \text{Ph} \quad \text{MgBr} \end{array}$

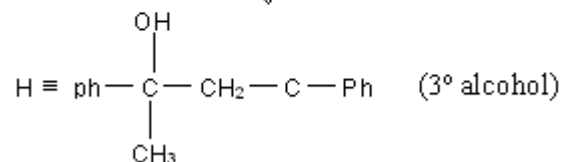
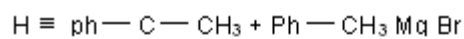
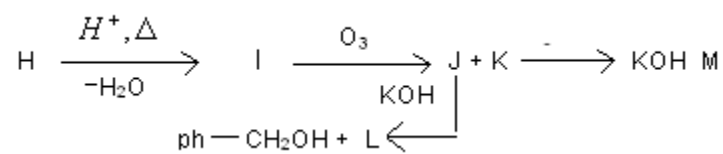
59. The Structure of compound I is

- a.
- b.
- c.
- d.

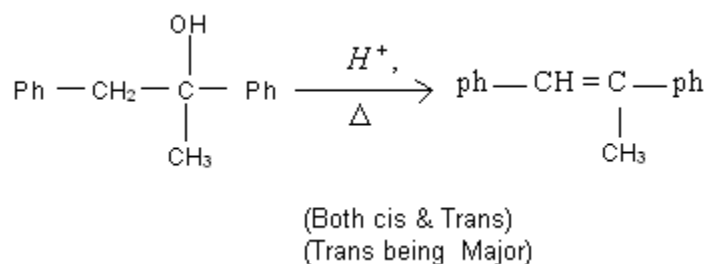
60. The structures of compounds J, K and L respectively are

- (A)  $\text{PhCOCH}_3$ ,  $\text{PhCH}_2\text{COCH}_3$  and  $\text{PhCH}_2\text{COO}^-\text{K}^+$
- (B)  $\text{PhCHO}$ ,  $\text{PhCH}_2\text{CHO}$  and  $\text{PhCOO}^-\text{K}^+$
- (C)  $\text{PhCOCH}_3$ ,  $\text{PhCH}_2\text{CHO}$  and  $\text{CH}_3\text{COO}^-\text{K}^+$
- (D)  $\text{PhCHO}$ ,  $\text{PhCOCH}_3$  and  $\text{PhCOO}^-\text{K}^+$

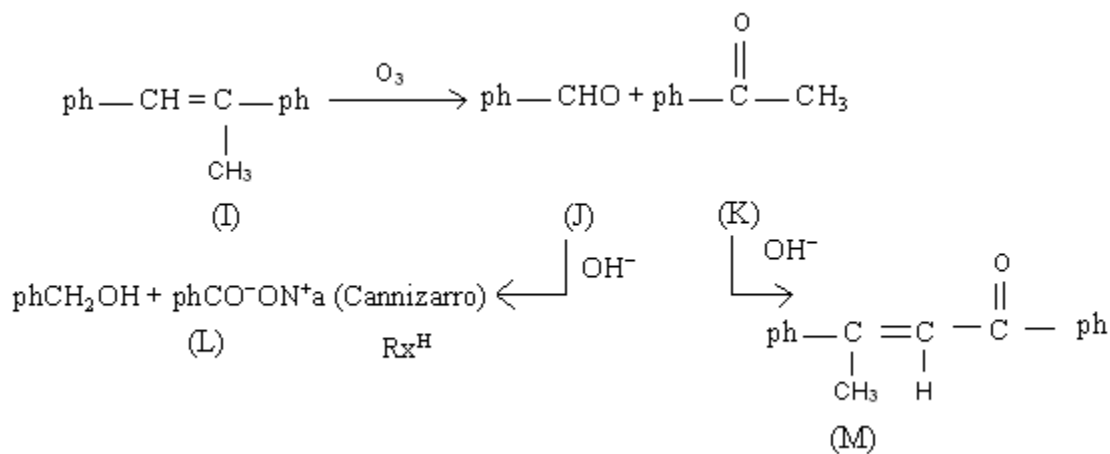
**Solution:** (B)



**Solution:** (A)



**Solution:** (D)



**Paragraph for Question Nos. 61 to 63**

In hexagonal systems of crystals, a frequently encountered arrangement of atoms is described as a hexagonal prism. Here, the top and bottom of cell are regular hexagons and three atoms are sandwiched in between them. A space-filling model of this structure, called hexagonal close-packed (HCP), is constituted of a sphere on a flat surface surrounded in the same plane by six identical spheres as closely as possible. These spheres are then placed over the first layer so that they touch each other and represent the second layer. Each one of these spheres touches three spheres of the bottom layer. Finally, the second layer is covered with a third layer that is identical to the bottom layer in relative position. Assume radius of every sphere to be 'r'

**61.** The number of atoms in this HCP unit cell is

- (A) 4    (B) 6    (C) 12    (D) 17

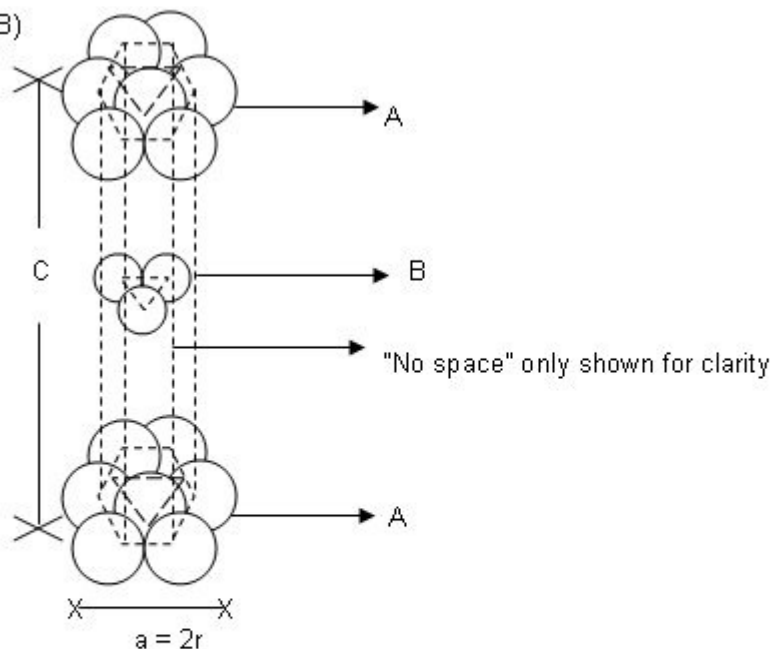
**62.** The volume of this HCP unit cell is

- (A)  $25\sqrt{2}r^3$  (B)  $16\sqrt{2}r^3$  (C)  $12\sqrt{2}r^3$  (D)  $\frac{64}{3\sqrt{3}}r^3$

63. The empty space in this HCP unit cell is

- (A) 74% (B) 47.6% (C) 32% (D) 26%

61- (B)



$$\text{No. of atoms in HCP} = (1 \times 3) + \left(\frac{1}{2} \times 2\right) + \left(\frac{1}{6} \times 12\right) = 6$$

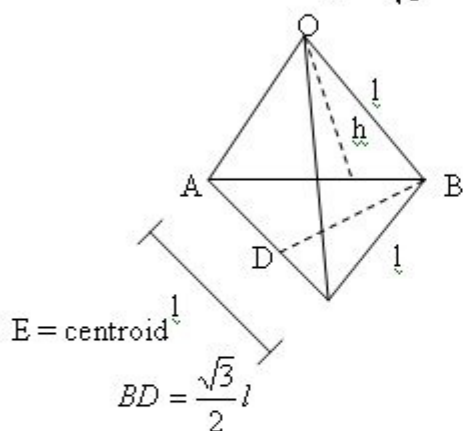
(Probability = 1) (No. of B atoms = 3) (6 in each layer = 12) (Probability = 1/6, 1/2) (Centre atoms = 2)

62-

Volume = (Area of base) X height

$$= \left( 6 \times \frac{\sqrt{3}}{4} a^2 \right) \times c$$

In an ideal HCP,  $\frac{c}{a} = \frac{2\sqrt{2}}{\sqrt{3}}$



$$BD = \frac{\sqrt{3}}{2} l$$

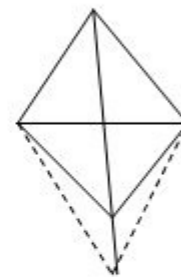
$$BE = \frac{2}{3} \times \frac{\sqrt{3}}{2} l = \frac{l}{\sqrt{3}}$$

In  $\Delta OBE$

$$h = \sqrt{l^2 - \frac{l^2}{3}} = \frac{\sqrt{2}}{\sqrt{3}} l$$

$$C = 2h = \frac{2\sqrt{2}}{\sqrt{3}} l = \frac{2\sqrt{2}}{\sqrt{3}} a$$

$$Volume = 6 \times \frac{\sqrt{3}}{4} \times a^2 \times \frac{2\sqrt{2}}{\sqrt{3}} a = \frac{6}{\sqrt{2}} a^3 = \frac{6}{\sqrt{2}} (2r)^3 = 24\sqrt{2}r^3$$



$C = 2h$  where  $h$  is height of tetrahedron

**Solution: (D)**

Volume fraction occupied

$$= \frac{(\text{no. of atoms}) \times \text{Volume of atoms}}{\text{Volume of unit cell}}$$

$$= \frac{6 \times \frac{4}{3} \Pi r^3}{24\sqrt{2}r^3} = \frac{\Pi}{3\sqrt{2}} = 0.74$$

Empty space = 0.26 => 26%

**SECTION – IV**

**Matrix Match Type**

This section contains 3 questions. Each questions contains statements given in two columns, which have to be matched . Statements in **Column I** are labelled as A, B, C and D whereas statements in **COLUMN II** are labelled as p, q, r and s . The answers to these questions have to be appropriately bubbled as illustrated in the following example.

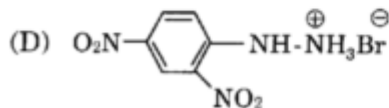
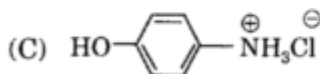
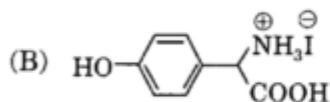
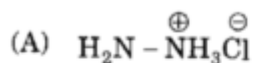
If the correct matches are A-q,B-p,C-r,D-q,then the correctly bubbled matrix will look like the following

	p	q	r	s
A	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
B	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
C	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
D	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

**64.** Match the compounds in **Column I** with their characteristic test(s)/ reaction(s) given in **Column II**.

Indicate your answer by darkening the appropriate bubbles of the 4 X 4 matrix given in the ORS.

**Column I**



**Column II**

(p) sodium fusion extract of the compound gives Prussian blue colour with  $\text{FeSO}_4$

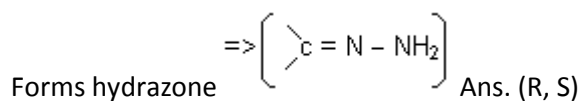
(q) gives positive  $\text{FeCl}_3$  test

(r) gives white precipitate with  $\text{AgNO}_3$

(s) reacts with aldehydes to form the corresponding hydrazone derivative

**Solution:**

(A) Because of  $\text{Cl}^-$  ion  $\Rightarrow$  ppt. With  $\text{AgNO}_3$  (wite)  $\Rightarrow$   $\text{AgCl}$  ( $\equiv r$ )



(B) It will test for "N" as Nitrogen is attached to "C" (≡p)

It will give test with  $\text{FeCl}_3$  as it contains phenolic group. (≡q)

**Solution:** (P, Q)

(C) As explained above, it should react [give test] for **Solution:** (P, Q, R)

(D) "Q" is not correct as  $\text{AgBr}$  is a yellow ppt. **Solution:** (P, S)

**65.** Match the entries in **Column I** with the correctly related quantum number(s) in **Column II**. Indicate your answer by darkening the appropriate bubbles of the 4 X 4 matrix given in the ORS.

Column I		Column II	
(A)	Orbital angular momentum of the electron in a hydrogen-like atomic orbital	(p)	Principal quantum number
(B)	A hydrogen-like one electron wave function obeying Pauli principle	(q)	Azimuthal quantum number
(C)	Shape, size and orientation of hydrogen-like atomic orbitals	(r)	Magnetic quantum number
(D)	Probability density of electron at the nucleus in hydrogen-like atom	(s)	Electron spin quantum number

65-

(A) Orbital Angular Momentum  $\equiv \sqrt{\ell(\ell + 1)} \frac{h}{2\pi} \Rightarrow$  Azimuthal Quantum Number

**Solution:** q

(B) H - like one -  $e^-$  wave function obeying Pauli principle spin Quantum Number.  $\rightarrow$  Not more than  $2e^-$ s in an orbital  $\Rightarrow$

**Solution:** s

(C) Shape : l  $\Rightarrow$  Azimuthal Quantum Number

size : n => Principal Quantum Number

Orientation : m => Magnetic Quantum Number

**Solution:** (P, Q, R)

(D) Probability density of  $e^-$  at the nucleus : => Principal Quantum Number.

**Solution:** (P)

**66.** Match the conversions in **Column I** with the type(s) of reaction(s) given in **Column II**. Indicate your answer by darkening the appropriate bubbles of the 4 X 4 matrix given in the ORS

Column I		Column II	
(A)	$PbS \rightarrow PbO$	(p)	Roasting
(B)	$CaCO_3 \rightarrow CaO$	(q)	Calcination
(C)	$ZnS \rightarrow Zn$	(r)	Carbon reduction
(D)	$Cu_2S \rightarrow Cu$	(s)	Self reduction

**Solution:**

