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"2008"
(Chemistry)

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Chemistry

PART - III
SECTION - I

Straight Objective Type

This section contains 9 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

45. The IUPAC name of $[\text{Ni}(\text{NH}_3)_4][\text{NiCl}_4]$ is
(A) Tetrachloronickel (II) – tetraamminenickel (II)
(B) Tetraamminenickel (II) – tetrachloronickel (II)
(C) Tetraamminenickel (II) – tetrachloronickelate (II)
(D) Tetrachloronickel (II) – tetraamminenickelate (0)

Sol. (C)
IUPAC name is tetraamminenickel (II) – tetrachloronickelate (II)

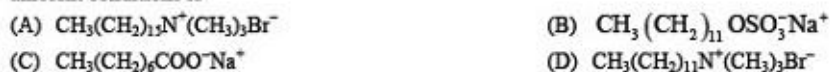
46. Among the following the coloured compound is
(A) CuCl (B) $\text{K}_2[\text{Cu}(\text{CN})_4]$
(C) CuF_2 (D) $[\text{Cu}(\text{CH}_3\text{CN})_4]\text{BF}_4$

Sol. (C)
In the crystalline form CuF_2 is blue coloured.

47. Both $[\text{Ni}(\text{CO})_4]$ and $[\text{Ni}(\text{CN})_4]^{2-}$ are diamagnetic. The hybridization of nickel in these complexes, respectively, are
(A) sp^3, sp^3 (B) sp^3, dsp^2
(C) dsp^2, sp^3 (D) dsp^2, dsp^2

Sol. (B)
 $\text{Ni}(\text{CO})_4 = sp^3$
 $[\text{Ni}(\text{CN})_4]^{2-} = dsp^2$

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



Sol.

(A)
 Critical concentration for micelle formation decreases as the molecular weight of hydrocarbon chain of surfactant grows because in this case true solubility diminishes and the tendency of surfactant molecule to associate increases.

49. Solubility product constant (K_{sp}) of salts of types MX, MX_2 and M_3X at temperature 'T' are 4.0×10^{-8} , 3.2×10^{-14} and 2.7×10^{-15} , respectively. Solubilities (mole dm^{-3}) of the salts at temperature 'T' are in the order



Sol.

(D)
 Solubility of (MX) = $\sqrt{4 \times 10^{-8}} = 2 \times 10^{-4}$

Solubility of (MX_2) = 8×10^{-5}

Solubility of (M_3X) = 1×10^{-4}

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

50. 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 C mol^{-1})



Sol.

(B)

$Q = i \times t$

$Q = 10 \times 10^{-3} \times t$



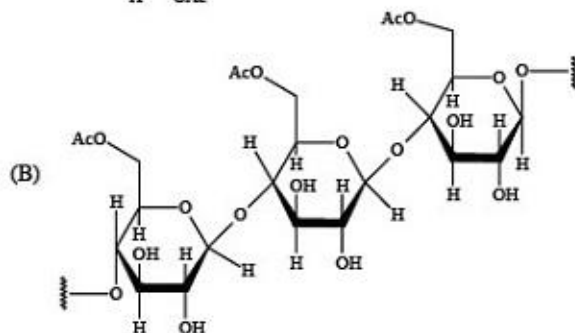
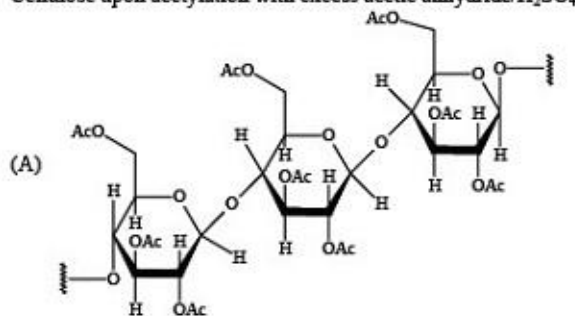
To liberate 0.01 mole of H_2 , 0.02 Faraday charge is required

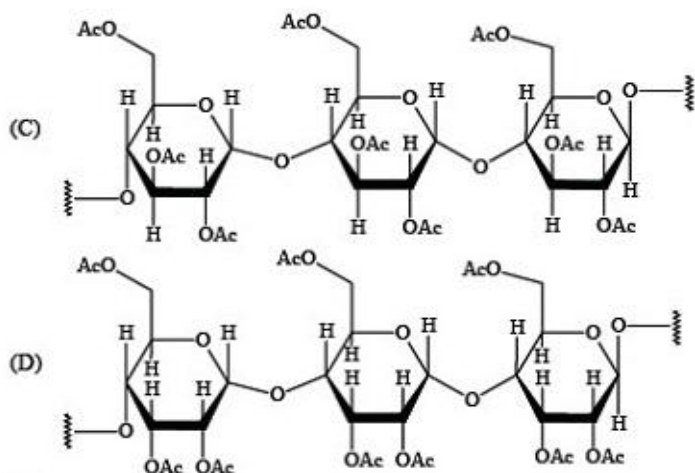
$Q = 0.02 \times 96500 \text{ C}$

$\therefore 0.02 \times 96500 = 10^{-2} \times t$

$t = 19.30 \times 10^4 \text{ sec}$

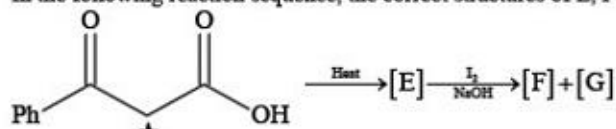
51. Cellulose upon acetylation with excess acetic anhydride/ H_2SO_4 (catalytic) gives cellulose triacetate whose structure is



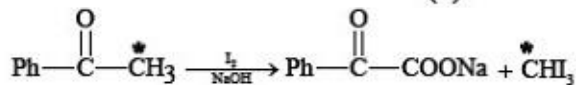
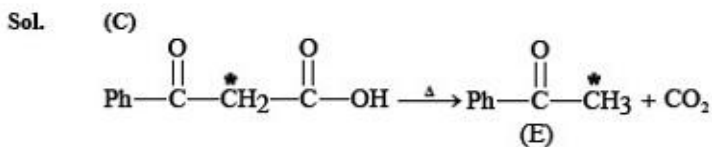
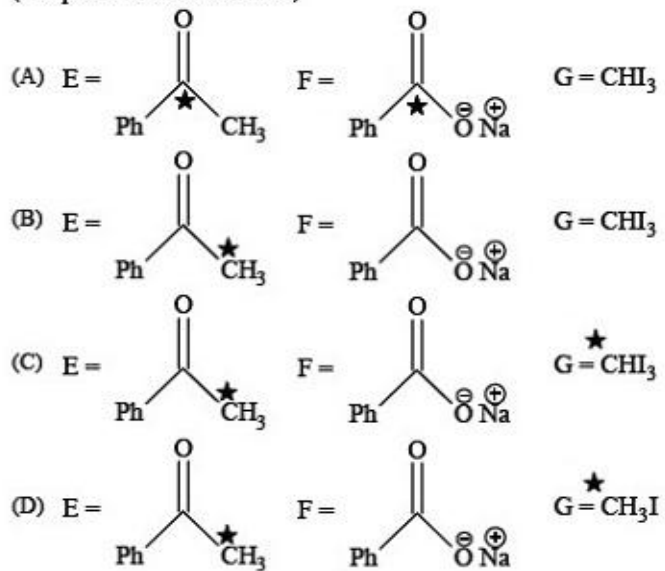


Sol. (A) As in cellulose β 1-4 glycosidic linkage is present.

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

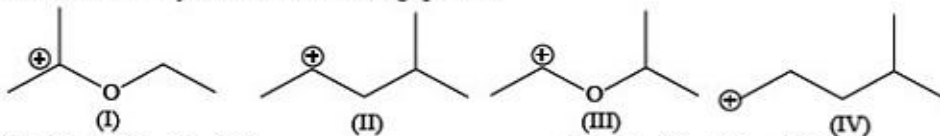


(* implies ^{13}C labelled carbon)



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53. The correct stability order for the following species is



(A) (II) > (IV) > (I) > (III)

(C) (III) > (I) > (IV) > (II)

(B) (I) > (II) > (III) > (IV)

(D) (I) > (III) > (II) > (IV)

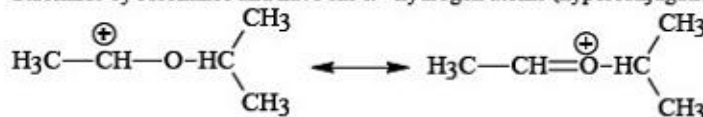
Sol.

(I)



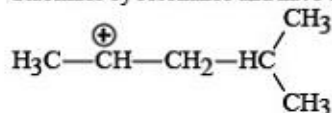
Stabilizes by resonance and have six α - hydrogen atoms (hyperconjugation)

(III)



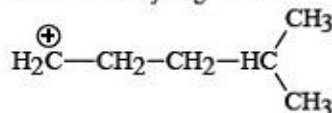
Stabilizes by resonance and have only three α - hydrogen atoms.

(II)



have five α - hydrogen atoms.

(IV)



have only two α - hydrogen atoms.

\therefore I > III > II > IV

SECTION - II

Reasoning Type

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

54. STATEMENT-1: The geometrical isomers of the complex $[M(NH_3)_4Cl_2]$ are optically inactive.

and

STATEMENT-2: Both geometrical isomers of the complex $[M(NH_3)_4Cl_2]$ possess axis of symmetry.

(A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is 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

Sol.

(B)

The molecule should not possess alternate axis of symmetry to be optically active.

55. STATEMENT-1: $[Fe(H_2O)_5NO]SO_4$ is paramagnetic.

and

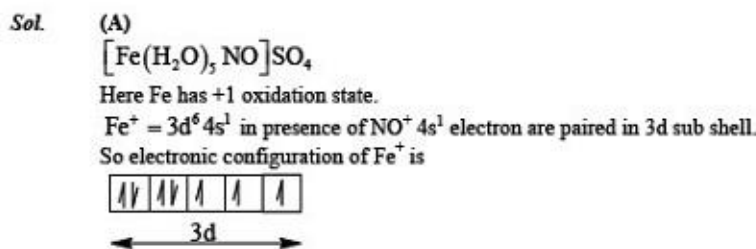
STATEMENT-2: The Fe in $[Fe(H_2O)_5NO]SO_4$ has three unpaired electrons.

(A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is correct explanation for STATEMENT-1

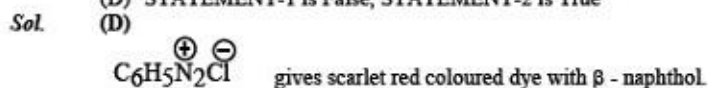
(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is NOT a correct explanation for STATEMENT-1

(C) STATEMENT-1 is True, STATEMENT-2 is False

(D) STATEMENT-1 is False, STATEMENT-2 is True



56. STATEMENT-1: Aniline on reaction with NaNO_2/HCl at 0°C followed by coupling with β -naphthol gives a dark blue coloured precipitate.
and
 STATEMENT-2: The colour of the compound formed in the reaction of aniline with NaNO_2/HCl at 0°C followed by coupling with β -naphthol is due to the extended conjugation.
 (A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is 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



57. 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 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
- Sol. (B)

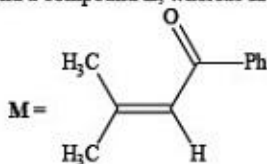
SECTION – III

Linked Comprehension Type

This section contains 2 paragraphs. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has 4 choices (A), (B), (C) and (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



$$\text{Total effective number of atoms} = 12 \times \frac{1}{6} + 2 \times \frac{1}{2} + 3 = 6$$

62. The volume of this HCP unit cell is

(A) $24\sqrt{2}r^3$

(B) $16\sqrt{2}r^3$

(C) $12\sqrt{2}r^3$

(D) $\frac{64r^3}{3\sqrt{3}}$

Sol. (A)

$$\text{Height of unit cell} = 4r\sqrt{\frac{2}{3}}$$

$$\text{Base area} = 6 \times \frac{\sqrt{3}}{4}(2r)^2$$

$$\begin{aligned} \text{Volume} &= \text{height} \times \text{base area} \\ &= 24\sqrt{2}r^3 \end{aligned}$$

63. The empty space in this HCP unit cell is

(A) 74%

(B) 47.6%

(C) 32%

(D) 26%

Sol. (D)

Packing fraction = 74%

Empty space = 26%

SECTION – IV

Matrix-Match Type

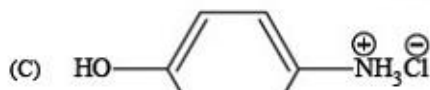
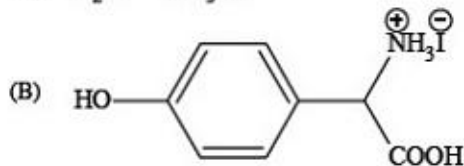
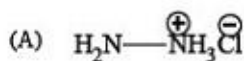
This contains 3 questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

If the correct match are A-p, A-s, B-r, C-p, C-q and D-s, then the correctly bubbled 4×4 matrix should be as follows:

	p	q	r	s
A	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
B	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
C	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" 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 4×4 matrix gives in the ORS.

Column I

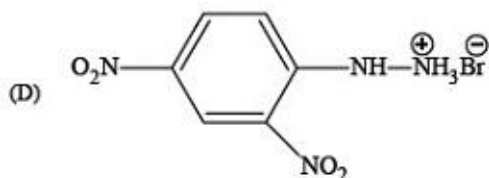


Column II

(p) sodium fusion extract of the compound gives Prussian blue colour with FeSO_4

(q) gives positive FeCl_3 test

(r) gives white precipitate with AgNO_3



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

Sol.
A - r, s
B - p, q
C - p, q, r
D - 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 4×4 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

Sol.
A - q
B - s
C - p, q, r
D - p, q, r

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 4×4 matrix given in the ORS.

Column I	Column II
(A) $\text{PbS} \rightarrow \text{PbO}$	(p) roasting
(B) $\text{CaCO}_3 \rightarrow \text{CaO}$	(q) calcination
(C) $\text{ZnS} \rightarrow \text{Zn}$	(r) Carbon reduction
(D) $\text{Cu}_2\text{S} \rightarrow \text{Cu}$	(s) self reduction

Sol.
A - p
B - q
C - p, r
D - p, s