IIT-JEE 2008 Chemistry Paper II

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. Solubility product constants (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 (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) $MX > M_3X > MX_2$

45. (D) $S^2 = 4 \times 10^{-8}$ $\therefore S = 2 \times 10^{-4}$
$4S^3 = 3.2 \times 10^{-14}$ $\therefore S = 2 \times 10^{-5}$
$27S^4 = 2.7 \times 10^{-15}$ $\therefore S = 10^{-4}$

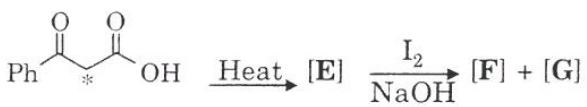
46. Among the following, the surfactant that will form micelles in aqueous solution at the lowest molar concentration at ambient conditions is
(A) $CH_3(CH_2)_{15}N^+(CH_3)_3Br^-$ (B) $CH_3(CH_2)_{11}OSO_3^-Na^+$
(C) $CH_3(CH_2)_6COO^-Na^+$ (D) $CH_3(CH_2)_{11}N^+(CH_3)_3Br^-$

46. (A) Micellization favoured by larger ions having one lyophobic part and another lyophilic part.

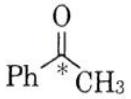
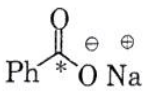
47. Electrolysis of dilute aqueous $NaCl$ solution was carried out by passing 10 milli ampre current. The time required to liberate 0.01 mol of H_2 gas at the cathode is
(1 Faraday = 96500 C mol^{-1})
(A) 9.65×10^4 sec (B) 19.3×10^4 sec
(C) 28.95×10^4 sec (D) 38.6×10^4 sec

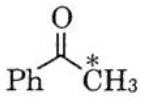
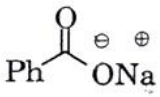
47. (B) $(10 \times 10^{-3} \times t) / (96500 \times 2) = 0.01$

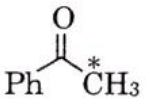
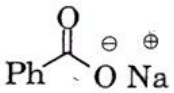
48. In the following reaction sequence, the correct structures of **E, F** and **G** are

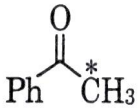
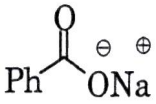


(* implies ^{13}C labelled carbon)

(A) **E** =  **F** =  **G** = CHI_3

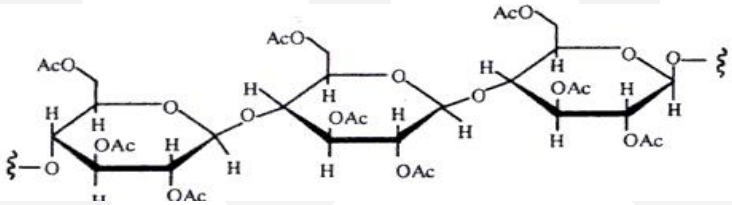
(B) **E** =  **F** =  **G** = CHI_3

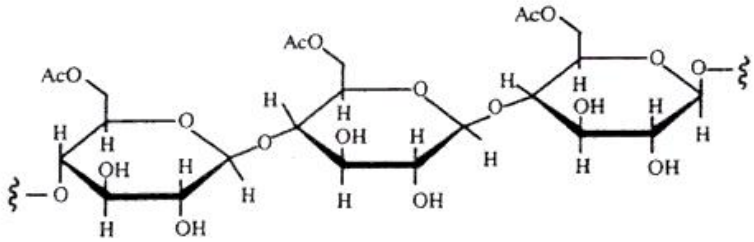
C) **E** =  **F** =  **G** = $\overset{*}{C}HI_3$

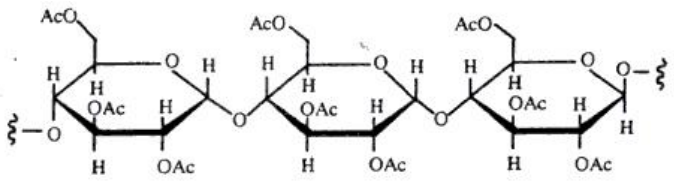
(D) **E** =  **F** =  **G** = $\overset{*}{C}H_3I$

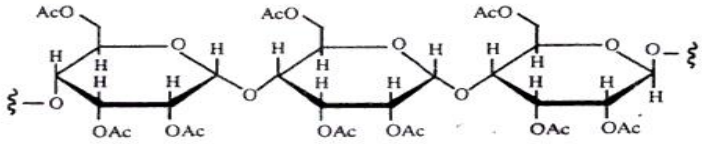
48. (C) $Ph-\overset{O}{\overset{\|}{C}}-\overset{*}{C}H_3$ (E) $Ph-\overset{O}{\overset{\|}{C}}-ONa$ (F) $\overset{*}{C}HI_3$ (G)

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

(A) 

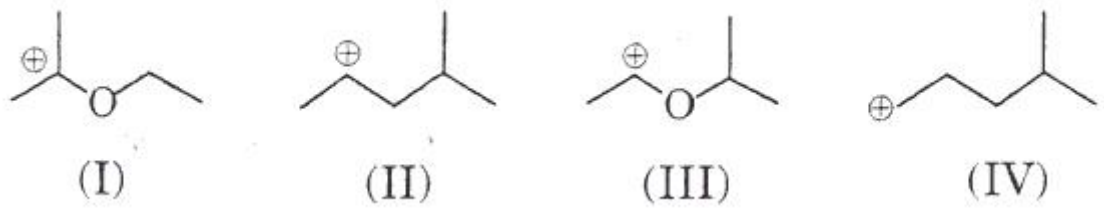
(B) 

(C) 

(D) 

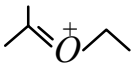
49. (B)

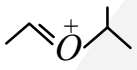
50. The correct stability order for the following species is



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

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

50. (D)  is most stable

 is 2nd most stable

 3rd most stable as it is 2°

 least stable as it is primary

51. The IUPAC name of $[Ni(NH_3)_4]$ $[NiCl_4]$ is
(A) Tetrachloronickel (II)-tetraamminenickel (II)
(B) Tetraamminenickel (II)-tetrachloronickel (II)
(C) Tetraamminenickel (II)-tetrachloronickelate (II)
(D) Tetrachloronickel (II)-tetraamminenickelate(0)

51. (C) IUPAC name of $[Ni(NH_3)_4]$ $[NiCl_4]$ is Tetraamminenickel (II)-tetrachloronickelate (II)

52. Both $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ are diamagnetic. The hybridisations 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

52. (B) $[Ni(CO)_4]$ is sp^3 hybridised and $[Ni(CN)_4]^{2-}$ is dsp^2 hybridised

53. Among the following, the coloured compound is
(A) $CuCl$ (B) $K_3[Cu(CN)_4]$ (C) CuF_2 (D) $[Cu(CH_3CN)_4]BF_4$

53. (C) Cu^+ is $3d^{10}$; colourless
Cu^{+2} is $3d^9$; unpaired electron present so coloured i.e CuF_2

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: $[Fe(H_2O)_5NO]\ SO_4$ 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 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

54. (A) $[Fe(H_2O)_5NO]\ SO_4$ contains Fe^+ and NO^+. *Fe* has three unpaired electrons

55. 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 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

55. (D) $C_6H_5N_2Cl$ with β-naphthol gives a scarlet red coloured dye phenyl azo β-napthol.

56. 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

56. (B)

57. 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 $[M(NH_3)_4Cl_2]$ posses 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

57. (B)

SECTION III

Linked Comprehension Type

This section contains 2 paragraphs. Based upon each pragraph, 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

In hexagonal systems of crystals**,** a frequently encountered arrangement of atoms is described as a hexagonal prism. Here, the top and bottom of the cell are regular hexagons and three atoms are sandwiched in between them. A space-filling model of this structure, called hexagonal close-paced (HCP)**,** is constituted of a sphere on a flat surface surrounded in the same plane by six identical spheres as closely as possible. Three spheres are then placed over the first layer so that they touch each other and represent the second layer. Each one of these three 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.

58. The number of atoms in this HCP unit cell is

(A) 4 (B) 6 (C) 12 (D) 17

58. (B) $2\{(120 \times 6) / (360 \times 2)\} + 3 + \frac{1}{2} \times 2 = 6$

59. 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) $\frac{64}{3\sqrt{3}} r^3$

59. (A) $(\sqrt{3} / 2) \times 3(2r)^3 \sqrt{(8 / 3)} = 24\sqrt{2}\, r^3$

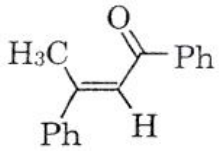
60. The empty space in this HCP unit cell is

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

60. (D) packing fraction = 76 % so, empty space = 26 %

Paragraph for Question Nos. 61 to 63

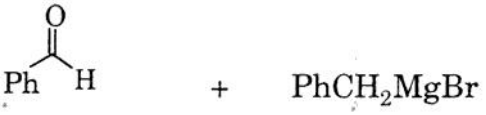
A tertiary alcohol **H** upon acid catalysed dehydration gives a product **I**. Ozonolysis of **I** leads to compouns **J** and **K**. Compound **J** upon reaction with *KOH* gives benzyl alcohol and a compound **L**, whereas **K** on reaction with *KOH* gives only **M**.

M = 

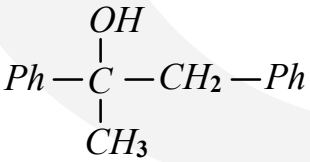
61. Compound **H** is formed by the reaction of

(A) 

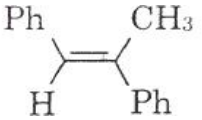
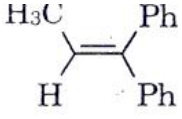
(B) 

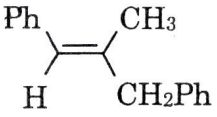
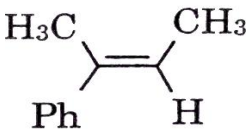
(C) 

(D) 

61. (B) *H* is 

62. The structure of compound **I** is

(A)  (B) 

(C)  (D) 

62. (A) **I** is $Ph-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CH-Ph$

63. The structures of compounds **J, K** and **L**, respectively, are
(A) $PhCOCH_3$, $PhCH_2COCH_3$ and $PhCH_2COO^-K^+$
(B) $PhCHO$, $PhCH_2CHO$ and $PhCOO^-K^+$
(C) $PhCOCH_3$, $PhCH_2CHO$ and $CH_3COO^-K^+$
(D) $PhCHO$, $PhCOCH_3$ and $PhCOO^-\ K^+$

63. (D) **J** = $Ph-CHO$ K = $Ph-\underset{\displaystyle O}{\overset{\displaystyle CH_3}{C}}$; **L** = $Ph-\underset{\displaystyle O}{\overset{\displaystyle OH}{C}}$

SECTION III
Matrix Match Type

This section contains 3 questions. Each question 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, A- r, B- p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix.

64. Match the entries in **Column I** with the correctly related quantum number(s) in **Column II** . Indicate your answer by darkening the appropriate bubbles.

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) Azimthal 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

64. (A) → (q) (B) → (pqrs) (C) → (pqr) (D) (pq)

65. 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) $PbS \rightarrow PbO$	(p) roasting
(B) $CaCO_3 \rightarrow CaO$	(q) calcination
(C) $ZnS \rightarrow Zn$	(r) carbon reduction
(D) $Cu_2S \rightarrow Cu$	(s) self reduction

65. (A) → (p) (B) → (q) (C) → (pr) (D) (ps)

$2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$

$CaCO_3 \rightarrow CaO + CO_2$

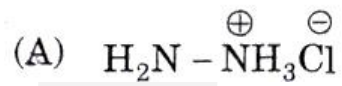
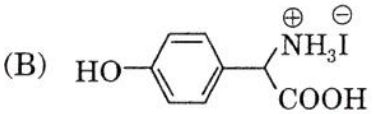
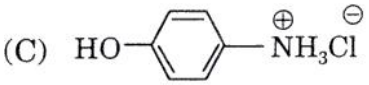
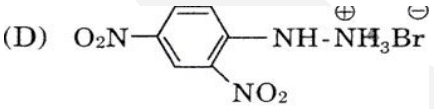
$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

$ZnO + C \rightarrow Zn + CO$

$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

$Cu_2S + 2Cu_2O \rightarrow 6Cu + SO_2$

66. Match the compounds in **Column I** with their charactertistic tests(s)/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) 	(p) Sodium fusion extract of the compound gives Prussian blue colour with $FeSO_4$
(B) 	(q) gives positive $FeCl_3$ test
(C) 	(r) gives white precipitate with $AgNO_3$
(D) 	(s) reacts with aldehydes to form the corresponding hydrazone derivative

66. (A) → (prs) (B) → (pq) (C) → (pqr) (D) (ps)