Date : **TEST ID: XIICH0902**
Marks : **CHEMISTRY**

COORDINATION COMPOUNDS

Single Correct Answer Type

31. Which of the following is not *meta* directing group?
a) $-SO_3H$ b) $-NO_2$ c) $-CN$ d) $-NH_2$

32. Which of the following is an organometallic compound?
a) Lithium methoxide b) Lithium acetate
c) Lithium dimethylamine d) Methyl lithium

33. Which among the following is very strong *o*-, *p*-directing group?
a) —Cl b) —O*R* c) $-NH_2$ d) —NH*R*

34. The type of hybridisation in tetrahedral complexes of metal atom is
a) dsp^2 b) d^2sp c) sp^3 d) sp^2

35. Chlorobenzene on heating with NaOH at 300°C under pressure gives:
a) Phenol b) Benzaldehyde c) Chlorophenol d) None of these

36. The coordination number of Fe in $[Fe(CN)_6]^{4-}$ $[Fe(CN)_6]^{3-}$ and $[FeCl_4]^-$ are respectively.
a) 2, 3, 3 b) 6, 6, 4 c) 6, 3, 3 d) 6, 4, 6

37. Consider the following statements
I. Chain and position isomerism are not possible together between two isomers
II. Tautomerism is a chemical phenomenon which is catalysed by acid as well as base
III. Tautomers are always metamers
IV. Tautomers are always functional isomers
Select the correct answer by using the codes given below
a) Only III is correct b) III and IV are correct
c) I, II and III are correct d) I, II and IV are correct

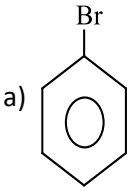
38. What is the EAN of nickel in $[Ni(CN)_4]^{2-}$?
a) 32 b) 35 c) 34 d) 36

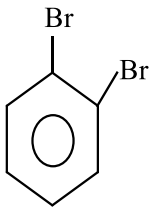
39. Which of the following alcohols is dehydrated most readily with conc. H_2SO_4?
a) *p*-$O_2NC_6H_4CH(OH)CH_3$
b) *p*-$ClC_6H_4CH(OH)CH_3$
c) *p*-$CH_3OC_6H_4CH(OH)CH_3$
d) $C_6H_5CH(OH)CH_3$

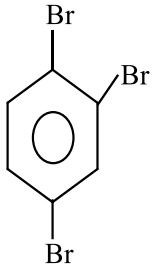
40. The compound having tetrahedral geometry is
a) $[Ni(CN)_4]^{2-}$ b) $[Pd(CN_4)]^{2-}$ c) $[PdCl_4]^{2-}$ d) $[NiCl_4]^{2-}$

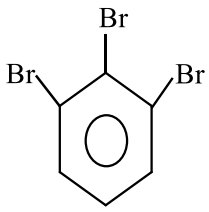
41. Identify '*Z*' in the change;

$$C_6H_5NH_2 \xrightarrow[280\ K]{NaNO_2/HCl} X \xrightarrow{CuBr/HBr} Z:$$

a) 

b) 

c) 

d) 

42. Which of the following is most acidic?
a) *p*-cresol b) *p*-chlorophenol c) *p*-nitrophenol d) *p*-aminophenol

43. Benzoylacetonato beryllium exhibit isomerism of the type

a) Structural b) Geometrical c) Optical d) Conformational

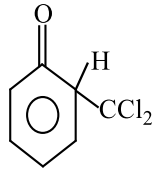
44. Which one of the following has a square planar geometry?
(At. No. Fe=26, Co=27, Ni=28, Pt=78)
a) $[CoCl_4]^{2-}$ b) $[FeCl_4]^{2-}$ c) $[NiCl_4]^{2-}$ d) $[PtCl_4]^{2-}$

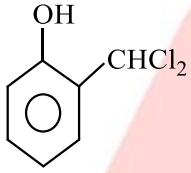
45. The number of ions formed on dissolving one molecule of $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$ in water is:
a) 4 b) 5 c) 3 d) 6

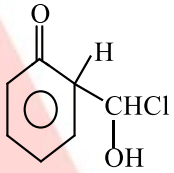
46. A solution of potassium ferrocyanide would contains-ions
a) 2 b) 3 c) 4 d) 5

47. Which of the following is not considerd as an organometallic compound?
a) Grignard reagent b) *cis*-platin c) Zeise's salt d) Ferrocene

48. When phenol is reacted with $CHCl_3$ and NaOH followed by acidification, salicylaldehyde is obtained. Which of the following species are involved in the above mentioned reaction as intermediates?
d) Both (a) and (b)

a) 

b) 

c) 

49. Number of geometrical isomers for the molecule

a) 2 b) 3 c) 6 d) 5

50. Which statement about coordination number of a cation is true?
a) Most metal ions exhibit only a single characteristic coordination number
b) The coordination number is equal to the number of ligands bonded to the metal atom
c) The coordination number is determined solely by the tendency to surround the metal atom with the same number of electrons as one of the rare gases
d) For most cations, the coordination number depends on the size, structure and charge of the ligands

51. Among the following, the strongest base is:
a) $C_6H_5NH_2$ b) p-NO_2—$C_6H_4NH_2$ c) m-NO_2—$C_6H_4NH_2$ d) $C_6H_5CH_2NH_2$

52. General formula for arenes is:
a) C_nH_{2n+6} b) C_nH_{2n+6y} c) C_nH_{2n} d) C_nH_{2n-6y}

53. Which of the following doesn't have a metal-carbon bond?
a) $Al(OC_2H_5)_3$ b) C_2H_5MgBr c) $K[Pt(C_2H_4)Cl_3]$ d) $Ni(CO)_4$

54. How many isomers are possible in $[Co(en)_2Cl_2]$?
a) 2 b) 4 c) 6 d) 1

55. How many carbon atoms in the molecule $HOOC-(CHOH)_2-COOH$ are asymmetric?
a) 1 b) 2 c) 3 d) None of these

56. In benzene, there is a delocalisation of π-electrons. Hence, each π-electron is attached by….carbon nuclei.
a) 2 b) 3 c) 6 d) 4

57. Which can be used to distinguish $C_6H_5NH_2$ and $C_6H_5CH_2NH_2$?
a) Diazotisation followed with coupling with phenol
b) Carbylamine reaction
c) Reimer-Tiemann reaction
d) None of the above

58. When RCOCl and $AlCl_3$ are used in Friedel-Craft's reaction, the electrophile is:
a) Cl^+ b) $RCOCl$ c) $R\overset{+}{C}O$ d) R^+

59. Thiophene is separated from benzene by:
a) Chlorination of thiophene
b) Sulphonation of thiophene
c) Nitration of thiophene

d) Oxidation of thiophene

60. A complex compound of $CO^{3+}$with molecular formula $COCl_x.yNH_3$ gives a total of 3 ions when dissolved in water. How many Cl^-ions satisfy both primary and secondary valencies in this complex?

a) 3 b) 1 c) 4 d) Zero

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CHEMISTRY

COORDINATION COMPOUNDS

ANSWER KEY

31)	d	32)	d	33)	d	34)	c
35)	a	36)	b	37)	d	38)	c
39)	c	40)	d	41)	a	42)	c
43)	c	44)	d	45)	b	46)	d
47)	b	48)	d	49)	b	50)	d
51)	d	52)	d	53)	a	54)	b
55)	b	56)	c	57)	a	58)	c
59)	a	60)	b				

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COORDINATION COMPOUNDS

HINTS AND SOLUTIONS

31 **(d)**
Follow Vorlander's rule.

32 **(d)**
Organometallic compounds are those in which metal is linked directly with carbon. CH_3Li, methyl lithium due to the presence of metal-carbon bond, is an organometallic compound.

33 **(d)**
The directive influence order is:
$O^- > NR_2 > NHR > NH_2 > OH > OCH_3 \approx NHCOCH_3 > CH_3 > X$

34 **(c)**

Hybridisation	Shape
dsp^2	Square planar
sp^3	Tetrahedral
sp^2	Trigonal planar

Hence, in tetrahedral complexes metal atom is sp^3 hybridised.

36 **(b)**
The number of ligands attached to the central metal ion is called the coordination number.
So, coordination numbers of Fe in
$[Fe\ (CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$ and $[FeCl_4]^-$ are 6, 6 and 4 respectively.

37 **(d)**
Tautomers may or may not be metamers

38 **(c)**
EAN=(Atomic number – O. S + 2 × C. N.)
Hence, EAN of Ni in $[Ni(CN)_4]^{2-} = (28 - 2 + 2 \times 4) = 34$

39 **(c)**
Electron repelling nature of methoxy gp. facilitate the protonation of alcohol.

40 **(d)**
$[Ni(Cl)_4]^{2-}$ oxidation state of Ni is +2
So, configuration of $Ni^{2+} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^8$
In Ni^{2+}

	$3d$				$4s$	$4p$		
⇅	⇅	⇅	1	1				

Thus, due to sp^3-hybridisation of Ni^{2+} in $[NiCl_4]^{2-}$, the shape of $[NiCl_4]^{2-}$is tetrahedral.

41 **(a)**
This is Sandmeyer's reaction.

42 **(c)**
p-nitrophenols are more acidic.

43 **(c)**
Benzoylacetonato beryllium exhibit optical isomerism as follows

bis (benzoylacetonato) beryllium (II) complex

44 **(d)**
Cl^- is a weak ligand but Cl^- cause the pairing of electron with large Pt^{2+} and consequently give dsp^2 hybridisation and square planar geometry.

45 **(b)**
It is a double salt;
$FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O \longrightarrow Fe^{2+} + 2SO_4^{2-} + 2NH_4^+$

46 **(d)**
Potassium ferrocyanide $K_4[Fe(CN)_6]$ will ionize as
$K_4[Fe(CN)_6] \rightleftharpoons 4K^+ + [Fe(CN)_6]^{4-}$
So, it will give five ions in solution

47 **(b)**
cis-platin is not a organimetallic compound because it has no carbon- metal bonding

48 **(d)**
Follow mechanism of Reimer-Tiemann reaction.

49 **(b)**
When n =even number then for two identical ends, number of geometrical isomers
$= 2^{n-1} + 2^{n/2-1}$
$= 2^1 + 2^0$
$= 3$

50 **(d)**
The characteristics of coordination number.

51 **(d)**
Aliphatic amines are more basic than aromatic amines as the later are more stablised due to resonance.

52 **(d)**
Aromatic hydrocarbons are called arenes with general formula C_nH_{2n-6y}, where $n \not< 6$ and y is no. of cyclic rings. Benzene has one ring and $n = 6$, *i. e.*, no. of carbon atoms. Thus, general formula is C_6H_6. All other aromatic hydrocarbons are derivative of benzene.

53 **(a)**
$Al(OC_2H_5)_3$ doesn't have metal-carbon bond.(*i.e.*, it is not an example of organometallic compound).

54 **(b)**
In $[Co(en)_2Cl_2]$, four isomers are possible, two geometrical isomers and two optical isomers.

Now, *cis*-isomer also show optical isomerism. *Cis* isomer exists in enantiomeric form as it is unsymmetrical.

Plane mirror

55 **(b)**
A carbon atom which is attached by four different group is called an asymmetric carbon atom or chiral centre
$HOOC(CHOH)_2COOH$ has two asymmetric carbon atom

56 **(c)**
Each π-electron is delocalised on each C-atom.

57 **(a)**
An orange-red dye is formed with $C_6H_5NH_2$.

59 **(a)**
Thiophene reacts more readily with H_2SO_4 than C_6H_6 giving thiophene sulphonic acid which is water soluble and thus, can be separated from C_6H_6. This can not be made by fractional

distillation because thiophene and C_6H_6 both have nearly same b.p.

60 **(b)**

As cobalt is present as CO^{3+} and coordination number of cobalt is 6, the molecular formula of compound should be $CoCl_3.yNH_3$. Now, as it gives a total of three ions when dissolved in water, its structural formula must be

$[CoCl(NH_3)_5]Cl_2$

$[CoCl(NH_3)_5]Cl_2 \rightleftharpoons [CoCl(NH_3)_5]^{2+} + 2Cl^-$

Thus, only one Cl^- ion is satisfying both primary and secondary valency of Co^{3+} in this compound.