CHEMISTRY: **Max. Marks: 60**

SECTION – I

(MULTIPLE CORRECT CHOICE TYPE)

This section contains **8 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE is/ are correct**

21. The drug Nipride $Na_2[Fe(CN)_5NO]$ is an inorganic complex used as a source of NO to lower blood pressure during surgery. Which of the following statement is correct for this drug ?

A) Its molecular mass decreases in the applied magnetic field

B) In this complex NO acts as three electron donor

C) It gives purple colour with sodium sulphide

D) The oxidation state of iron in this complex is +3

22. The correct statements about the transition elements is/are

A) the common oxidation state is +3 and its stability decreases across the period

B) transition elements of 3d series have almost same atomic sizes from Cr to Cu

C) the stability of +2 oxidation state increases across the period

D) Some transition elements like Ni, Fe, Cr may show zero oxidation state in some of their compounds

23. Which of the following are correct ?

A) atoms of the transition elements are smaller than those of the group I or II elements in the same horizontal period

B) the covalent radius of Hf and the ionic radius of Hf^{4+} are smaller or nearly same as the corresponding values for Zr

C) The covalent and ionic radii of Nb are almost same as the values for Ta

D) The covalent radii of the elements decreases from left to right across a row in the transition series up to middle and become nearly same in the middle but at the end (after Cu)there is slight increase .

24. The first row transition metals oxides are generally formed from the reaction of metals and oxygen at high Temperatures. point out the correct statements?

A) generally the oxides are acidic when the metal is in low oxidation state and basic in high oxidation state

B) The oxides are generally amphoteric if the metal is in the intermediate oxidation state

C) the basic and amphoteric oxides dissolve in non – oxidizing acids forming hexa – aquo ions $[M(H_2O_6]^{n+}$

D) A few of these oxides dissolve in bases to form oxometallic salts

25. A complex $Co(NH_3)_4CO_3Cl$ can exist in three isomers regarding these isomers which of the following statement is correct

A) In the isomer that give precipitate with $AgNO_3$ CO_3^{2-} act as bidentate ligand

B) In the isomer that do not give precipitate with $AgNO_3$ CO_3^{2-} act as unidentate ligand

C) The isomer which give precipitate with $AgNO_3$ do not exhibit stereosomerism

D) The isomer that do not give precipitate with $AgNO_3$ exhibit geometrical isomerism

26. Which of the following statement is correct regarding M(AA)(BB) cd [(AA) and (BB) are symmetric bidenatate ligands]

A) It can exhibit geometrical isomerism

B) Total number of possible isomers for this compound is 5

C) Only isomers having cd in cis position can exhibit optical isomerism but not trans isomers

D) Only isomers having cd in trans position can exhibit optical isomerism but not cis isomers

27. Which of the following is correct ?

A) aqueous solutions of $KMnO_4$ are intrinsically unstable and decompose slowly depositing brown MnO_2 on standing

B) In concentrated alkalies the permanganate gives manganate

C) If small quantity of $KMnO_4$ is added to concentrated H_2SO_4, a green solution containing MnO_3^- ions is formed

D) With larger amounts of $KMnO_4$, covalent, highly explosive green oily Mn_2O_7 is formed

28. Which of the following statements are correct?

A) a green aqueous solution Ni(II) turns to yellow on addition of cyanide

B) The increasing order of the frequency of light absorbed for the given complexes $[CrCl_6]^{3-} < [Cr(NH_3)_6]^{3+} < [Cr(CN)_6]^{3-}$

C) $[Co(NH_3)_5(ONO)]^{2+}$ (O – bonded) is less stable than (N – bonded)

D) All four coordinate complexes of Pd(II), Pt(II) Au(III) are square planar

SECTION - II
(COMPREHENSION TYPE)

This section contains **4 groups of questions.** Each group has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which **ONLY ONE** is **correct.**

Paragraph for Questions 29 and 30

The dissociation of complex may be expressed as $[MLx]^{4+} \rightleftharpoons M^{+} + xL$ and equilibrium constant of this is known as instability constant. Which is a measure of stability. The stability of complex depends on EAN of central atom. Charge an metal ion, basic nature of ligand, Chelation

29. Which one of the following does not follow EAN rule.

A) $Fe(CO)_5$ B) $V(CO)_6$

C) $K_4[Fe(CN)_6]$ D) $Mn_2(CO)_{10}$

30. Which complex is most stable where k_a is instability constant

A) $[Cu(CN)_2]^{-}$ $k_a = 1\times10^{-16}$ B) $[Fe(CN)_6]^{4-}$ $k_a = 1\times10^{-37}$

C) $[Fe(CN)_6]^{3-}$ $k_a = 1\times10^{-44}$ D) $[Ag(CN)_2]^{-}$ $k_a = 1\times10^{-20}$

Paragraph for Questions 31 and 32

An inorganic salt (A) on heating upto 230^0C loses its colour and forms (B), the loss of water from salt (A) is 36.07% by weight. Small amount of salt (B) is dissolved in 1L of water. Assuming no volume change after the dissolution. 100mL of the solution is treated with excess KI solution, results a precipitate (C) with the evolution of I_2. The liberated I_2 requires 20 mL of 0.25 M sodium thiosulphate solution. [mol. wt. Cu = 63.5, Zn = 65.5, Fe = 56, Mg = 24]

31. Molecular formula of inorganic slat (A) is

A) $FeSO_4 \cdot 7H_2O$ B) $ZnSO_4.7H_2O$

C) $CuSO_4 .5H_2O$ D) $MgSO_4.7H_2O$

32. When salt (B) solution is treated with KI, it result a precipitate (C). The formula of (C) is

A) ZnI_2 B) CuI_2 C) Cu_2I_2 D) FeI_2

Paragraph for Questions 33 and 34

The step wise stability constant (K) and over all formation constant (β) are expressed as follows

$$M + L \rightleftharpoons ML \quad K_1 = \frac{[ML]}{[M][L]}$$

$$ML + L \rightleftharpoons ML_2 \quad K_2 = \frac{[ML_2]}{[ML][L]}$$

$$ML_2 + L \rightleftharpoons ML_3 \quad K_3 = \frac{[ML_3]}{[ML][L]}$$

$$ML_{n-1} + L \rightleftharpoons ML_n \quad K_n = \frac{[ML_n]}{[ML_{n-1}]}$$

$$M + L \rightleftharpoons ML \quad \beta_1 = \frac{[ML]}{[M][L]}$$

$$M + 2L \rightleftharpoons ML_2 \qquad \beta_2 = \frac{[ML_2]}{[M][L]^2}$$

$$M + 3L \rightleftharpoons ML_3 \qquad \beta_3 = \frac{[ML_3]}{[M][L]^3}$$

$$M + nL \rightleftharpoons ML_n \qquad \beta_n = \frac{[ML_n]}{[M][L]^n}$$

33. $\sum_{i=1}^{i=3} \log K_i = x,\ x\ is$

A) $\log \beta_1$ B) $\log(\beta_1 + \beta_2 + \beta_3)$ C) $\log \beta_3$ D) $\log(\beta_1 + \beta_3)$

34. $\left[Cd(H_2O)_4\right]^{2+} + 4NH_3 \rightleftharpoons \left[Cd(NH_3)_4\right]^{2+} + 4H_2O, \log \beta_1$

$\left[Cd(H_2O)_4\right]^{2+} + 2en \rightleftharpoons \left[Cd(en)_2\right]^{2+} + 4H_2O, \log \beta_2$.

The reason for $\log \beta_2 > \log \beta_1$, is due to

A) difference in the enthalpy (ΔH) of the reaction

B) difference in the entropy (ΔS) of the reaction

C) difference in the molecular weights of the ligands.

D) bulkyness of the en ligand compared to NH_3.

Paragraph for Questions 35 and 36

An isomer of the complex $Co(en)_2(H_2O)ICl_2$, on reaction with concentrated H_2SO_4 suffers loss in weight and on reaction with $AgNO_3$ solution gives a yellow precipitate, which is insoluble in NH_3 solution

35. If all the ligands in the co-ordination sphere of the above complex are replaced by CN^- ion, then the magnetic moment of the complex ion will be:

A) 0.0 BM B) 5.9 BM C) 4.9 BM D) 1.73 BM

36. If one mole of original complex is treated with excess $Pb(NO_3)_2$ solution, then the number of moles of white precipitate formed will be:

A) 2.0 B) 1.0 C) 0.0 D) 3.0 3

SECTION – III

(MATRIX MATCH TYPE)

This section contains **4 multiple choice questions.** Each question has matching lists. The codes for the lists have choices (A), (B), (C), and (D) out of which **ONLY ONE** is correct.

37. Match the following Columns

Column – I **[pairs of complex compounds]**	**Column – II** **[property which is different in given pair]**
A) $\left[Ni(CO)_4\right]$ and $K_2\left[Ni(CN)_4\right]$	P) Magnetic moment
B) $\left[Cu(NH_3)_4\right.$ and $\left.K_3\left[Cu(CN)_4\right]\right]$	Q) oxidation no. of central metal
C) $K_2[NiCl_4]$ and $K_4\left[Ni(CN)_4\right]$	R) Geometry
D) $K_2[NiCl_4]$ and $K_2[PtCl_4]$	S) EAN of central atom

Code:

	A	**B**	**C**	**D**
A)	RS	PQR	PQS	PRS
B)	QRS	PRS	PQS	QRS
C)	QRS	PQRS	PQS	PRS
D)	PRS	QRS	RS	PQ

38. Match List-I with List-II..

List I (Property)	**List II (Transition elements)**
A) Highest oxidation state	P) Cr
B) Highest density	Q) Os
C) Element with maximum unpaired electrons	R) Tc
D) Radioactive transition element	S) Ru

Code:

	A	**B**	**C**	**D**
A)	QS	Q	P	R
B)	Q	QS	R	P
C)	P	Q	R	S
D)	Q	P	RS	R

39. Match the following

Column I	Column II
A) $FeSO_4 \xrightarrow{\Delta}$	P) One of the products is coloured due to charge transfer
B) $Mn^{2+} + S_2O_8^{2-} + H_2O \rightarrow$	Q) One of the products is in + VI oxidation state
C) $Na_2Cr_2O_7 + con.H_2SO_4 \rightarrow$	R) Redox reaction
D) $N_2H_4 + CuSO_4 \rightarrow$	S) One or more of the products is/are acidic oxide/s

Code:

	A	B	C	D
A)	PQ	QRS	PR	PRS
B)	QRS	PRS	PQ	PR
C)	PRS	QRS	PQR	QR
D)	QRS	PQR	PQS	QR

40. Match the following

	Column – I (Compound)		**Column – II (Molar conductivity)**
(A)	$CoCl_3 . 3NH_3$	P)	600
(B)	$Co(NO_2)_3 . 2KNO_2 . NH_3$	Q)	0
(C)	$Co(NO_2)_3 . 3KNO_2$	R)	900
(D)	$Co(NO_2)_3 . KNO_2 . 2NH_3$	S)	1650

Code:

	A	**B**	**C**	**D**
A)	Q	S	R	P
B)	Q	R	S	P
C)	Q	P	R	S
D)	P	Q	R	S