

JEE MAIN COORDINATION COMPOUNDS — CRYSTAL FIELD THEORY (CFT) — PYQS

Max. Marks: 112

Questions: 28

Section A (MCQ) — 22 questions

Q.1 Match the LIST-I with LIST-II

[JEE Main 2026 (Online) 6th April Morning Shift]

Electronic configuration of tetrahedral metal ion		Crystal Field Stabilization Energy (Δ_t)	
A.	d^2	I.	-0.6
B.	d^4	II.	-0.8
C.	d^6	III.	-1.2
D.	d^8	IV.	-0.4

- (1) A-III, B-IV, C-II, D-I
 (2) A-III, B-I, C-IV, D-II
 (3) A-III, B-IV, C-I, D-II
 (4) A-II, B-I, C-IV, D-III

 Scan or tap for the full solution
 

Q.2 Which of the following are true about the energy of the given d-orbitals of a tetrahedral complex?

- A. $d_{xy} = d_{xz} > d_{x^2-y^2}$ B. $d_{xy} = d_{yz} > d_{z^2}$
 C. $d_{x^2-y^2} > d_{z^2} > d_{xz}$ D. $d_{x^2-y^2} = d_{z^2} < d_{xz}$

Choose the correct answer from the options given below : [JEE Main 2026 (Online) 6th April Morning Shift]

- (1) A, B and D only (2) A and B only
 (3) B and D only (4) B, C and D only

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Q.3 Given below are two statements:

Statement-I: Each electron in e_g orbitals destabilizes the orbitals by $+0.6\Delta_o$ and each electron in the t_{2g} orbitals stabilizes the orbitals by $-0.4\Delta_o$ in an octahedral field on the basis of crystal field theory.

Statement-II: All the d - orbitals of the transition metals have the same energy in their free atomic state but when a complex is formed the ligands destroy the degeneracy of these orbitals on the basis of crystal field theory.

In the light of the above statements, choose the correct answer from the options given below

[JEE Main 2026 (Online) 5th April Morning Shift]

- (1) Both Statement-I and Statement-II are correct
 (2) Both Statement-I and Statement-II are incorrect
 (3) Statement-I is correct but Statement-II is incorrect
 (4) Statement-I is incorrect but Statement-II is correct

 Scan or tap for the full solution
 

Q.4 Consider the metal complexes $[\text{Ni}(\text{en})_3]^{2+}$ (A), $[\text{NiCl}_4]^{2-}$ (B) and $[\text{Ni}(\text{NH}_3)_6]^{2+}$ (C). Choose the CORRECT option by considering the number of unpaired electrons present in (A), (B) and (C) respectively and the order of frequency of absorption.

[JEE Main 2026 (Online) 4th April Evening Shift]

- (1) 2, 2, 2 and (A) > (C) > (B)
 (2) 0, 2, 0 and (A) > (C) > (B)
 (3) 2, 2, 0 and (B) > (C) > (A)
 (4) 2, 2, 2 and (C) > (A) > (B)

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Q.5 Match List - I with List - II.

[JEE Main 2026 (Online) 2nd April Morning Shift]

Chromium (III) Complexes (en = ethylene diamine)		Δ_o (cm ⁻¹)	
A.	$[\text{Cr}(\text{CN})_6]^{3-}$	I.	15,060
B.	$[\text{CrF}_6]^{3-}$	II.	17,400
C.	$[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$	III.	22,300
D.	$[\text{Cr}(\text{en})_3]^{3+}$	IV.	26,600

- (1) A-I, B-II, C-III, D-IV
 (2) A-II, B-III, C-IV, D-I
 (3) A-III, B-IV, C-I, D-II
 (4) A-IV, B-I, C-II, D-III

 Scan or tap for the full solution
 

Q.6 The correct increasing order of spin-only magnetic moment values of the complex ions $[\text{MnBr}_4]^{2-}$ (A), $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ (B), $[\text{Ni}(\text{CN})_4]^{2-}$ (C) and $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ (D) is :

[JEE Main 2026 (Online) 28th January Evening Shift]

- (1) $A = B < D < C$ (2) $C = D < B < A$
 (3) $C < B < D < A$ (4) $A = B < C < D$

Scan or tap for the
full solution



Q.7 Given below are two statements :

Statement-I: $[\text{CoBr}_4]^{2-}$ ion will absorb light of lower energy than $[\text{CoCl}_4]^{2-}$ ion.

Statement-II: In $[\text{CoI}_4]^{2-}$ ion, the energy separation between the two sets of d-orbitals is more than $[\text{CoCl}_4]^{2-}$ ion.

In the light of the above statements, choose the correct answer from the options given below :

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1) Both Statement-I and Statement-II are false
 (2) Both Statement-I and Statement-II are true
 (3) Statement-I is false but Statement-II is true
 (4) Statement-I is true but Statement-II is false

Scan or tap for the
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Q.8 Consider the transition metal ions Mn^{3+} , Cr^{3+} , Fe^{3+} and Co^{3+} and all form low spin octahedral complexes. The correct decreasing order of unpaired electrons in their respective d-orbitals of the complexes is

[JEE Main 2026 (Online) 22nd January Morning Shift]

- (1) $\text{Cr}^{3+} > \text{Mn}^{3+} > \text{Fe}^{3+} > \text{Co}^{3+}$
 (2) $\text{Mn}^{3+} > \text{Fe}^{3+} > \text{Co}^{3+} > \text{Cr}^{3+}$
 (3) $\text{Fe}^{3+} > \text{Co}^{3+} > \text{Mn}^{3+} > \text{Cr}^{3+}$
 (4) $\text{Cr}^{3+} > \text{Fe}^{3+} > \text{Co}^{3+} > \text{Mn}^{3+}$

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full solution



Q.9 $[\text{Ni}(\text{PPh}_3)_2\text{Cl}_2]$ is a paramagnetic complex. Identify the INCORRECT statements about this complex.

- A. The complex exhibits geometrical isomerism.
 B. The complex is white in colour.
 C. The calculated spin-only magnetic moment of the complex is 2.84 BM.
 D. The calculated CFSE (Crystal Field Stabilization Energy) of Ni in this complex is $-0.8\Delta_o$.
 E. The geometrical arrangement of ligands in this complex is similar to that in $\text{Ni}(\text{CO})_4$.

Choose the correct answer from the options given below :

[JEE Main 2026 (Online) 22nd January Evening Shift]

- (1) C and D Only (2) A, B and D Only
 (3) C, D and E Only (4) A and B Only

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full solution



Q.10 Given below are two statements :

Statement-I: Crystal Field Stabilization Energy (CFSE) of $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ is greater than that of $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$.

Statement-II: Potassium ferricyanide has a greater spin-only magnetic moment than sodium ferrocyanide.

In the light of the above statements, choose the correct answer from the options given below :

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1) Statement-I is true but Statement-II is false
 (2) Both Statement-I and Statement-II are true
 (3) Both Statement-I and Statement-II are false
 (4) Statement-I is false but Statement-II is true

Scan or tap for the
full solution



Q.11 The number of unpaired electrons responsible for the paramagnetic nature of the following complex species are respectively :

$[\text{Fe}(\text{CN})_6]^{3-}$, $[\text{FeF}_6]^{3-}$, $[\text{CoF}_6]^{3-}$, $[\text{Mn}(\text{CN})_6]^{3-}$

[JEE Main 2025 (Online) 7th April Evening Shift]

- (1) 1, 5, 4, 2 (2) 1, 4, 4, 2
 (3) 1, 5, 5, 2 (4) 1, 1, 4, 2

Scan or tap for the
full solution



Q.12 Which one of the following complexes will have $\Delta_o = 0$ and $\mu = 5.96$ B.M.?

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $[\text{FeF}_6]^{4-}$ (2) $[\text{Mn}(\text{SCN})_6]^{4-}$
 (3) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (4) $[\text{Fe}(\text{CN})_6]^{4-}$

Scan or tap for the
full solution



Q.13 'X' is the number of electrons in t_{2g} orbitals of the most stable complex ion among $[\text{Fe}(\text{NH}_3)_6]^{3+}$, $[\text{FeCl}_6]^{3-}$, $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$. The nature of oxide of vanadium of the type V_2O_X is :

[JEE Main 2025 (Online) 4th April Evening Shift]

- (1) Amphoteric (2) Acidic
 (3) Basic (4) Neutral

Scan or tap for the
full solution



Q.14 Given below are two statements :

Statement-I: In octahedral complexes, when $\Delta_o < P$ high spin complexes are formed. When $\Delta_o > P$ low spin complexes are formed.

Statement-II: In tetrahedral complexes because of $\Delta_t < P$, low spin complexes are rarely formed.

In the light of the above statements, choose the most appropriate answer from the options given below :

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) Both Statement-I and Statement-II are incorrect
 (2) Statement-I is correct but Statement-II is incorrect
 (3) Statement-I is incorrect but Statement-II is correct
 (4) Both Statement-I and Statement-II are correct

Scan or tap for the full solution



Q.15 The d-orbital electronic configuration of the complex among $[\text{Co}(\text{en})_3]^{3+}$, $[\text{CoF}_6]^{3-}$, $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$ that has the highest CFSE is:

[JEE Main 2025 (Online) 2nd April Evening Shift]

- (1) $t_{2g}^6 e_g^0$ (2) $t_{2g}^3 e_g^2$ (3) $t_{2g}^4 e_g^2$ (4) $t_{2g}^6 e_g^4$

Scan or tap for the full solution



Q.16 The correct increasing order of stability of the complexes based on Δ_0 value is :

- I. $[\text{Mn}(\text{CN})_6]^{3-}$
 II. $[\text{Co}(\text{CN})_6]^{4-}$
 III. $[\text{Fe}(\text{CN})_6]^{4-}$
 IV. $[\text{Fe}(\text{CN})_6]^{3-}$

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) I < II < IV < III (2) IV < III < II < I
 (3) III < II < IV < I (4) II < III < I < IV

Scan or tap for the full solution



Q.17 The calculated spin-only magnetic moments $K_3[\text{Fe}(\text{OH})_6]$ and $K_4[\text{Fe}(\text{OH})_6]$ respectively are :

[JEE Main 2025 (Online) 29th January Evening Shift]

- (1) 4.90 and 4.90 B.M. (2) 4.90 and 5.92 B.M.
 (3) 5.92 and 4.90 B.M. (4) 3.87 and 4.90 B.M.

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Q.18 The conditions and consequence that favours the $t_{2g}^3 e_g^1$ configuration in a metal complex are :

[JEE Main 2025 (Online) 24th January Evening Shift]

- (1) strong field ligand, low spin complex
 (2) strong field ligand, high spin complex
 (3) weak field ligand, high spin complex
 (4) weak field ligand, low spin complex

Scan or tap for the full solution



Q.19 The d-electronic configuration of an octahedral Co (II) complex having magnetic moment of 3.95 BM is:

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $e^4 t^3$ (2) $t_{2g}^6 e_g^1$ (3) $t_{2g}^5 e_g^2$ (4) $t_{2g}^3 e_g^0$

Scan or tap for the full solution



Q.20 In which of the following complexes the CFSE, Δ_0 will be equal to zero?

[JEE Main 2025 (Online) 22nd January Morning Shift]

- (1) $K_3[\text{Fe}(\text{SCN})_6]$ (2) $[\text{Fe}(\text{en})_3]\text{Cl}_3$
 (3) $[\text{Fe}(\text{NH}_3)_6]\text{Br}_2$ (4) $K_4[\text{Fe}(\text{CN})_6]$

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Q.21 The correct order of the following complexes in terms of their crystal field stabilization energies is :

[JEE Main 2025 (Online) 22nd January Evening Shift]

- (1) $[\text{Co}(\text{NH}_3)_4]^{2+} < [\text{Co}(\text{NH}_3)_6]^{2+} < [\text{Co}(\text{NH}_3)_6]^{3+} < [\text{Co}(\text{en})_3]^{3+}$
 (2) $[\text{Co}(\text{NH}_3)_4]^{2+} < [\text{Co}(\text{NH}_3)_6]^{2+} < [\text{Co}(\text{en})_3]^{3+} < [\text{Co}(\text{NH}_3)_6]^{3+}$
 (3) $[\text{Co}(\text{NH}_3)_6]^{2+} < [\text{Co}(\text{NH}_3)_6]^{3+} < [\text{Co}(\text{NH}_3)_4]^{2+} < [\text{Co}(\text{en})_3]^{3+}$
 (4) $[\text{Co}(\text{en})_3]^{3+} < [\text{Co}(\text{NH}_3)_6]^{3+} < [\text{Co}(\text{NH}_3)_6]^{2+} < [\text{Co}(\text{NH}_3)_4]^{2+}$

Scan or tap for the full solution



Q.22 Identify the homoleptic complex(es) that is/are low spin.

- A. $[\text{Fe}(\text{CN})_5\text{NO}]^{2-}$ B. $[\text{CoF}_6]^{3-}$
 C. $[\text{Fe}(\text{CN})_6]^{4-}$ D. $[\text{Co}(\text{NH}_3)_6]^{3+}$
 E. $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$

Choose the correct answer from the options given below :

[JEE Main 2025 (Online) 22nd January Evening Shift]

- (1) C and D only (2) C only
 (3) A and C only (4) B and E only

Scan or tap for the full solution



Section B (Numerical) — 6 questions

Q.23 Number of paramagnetic complexes among the following is _____.

$[\text{MnBr}_4]^{2-}$, $[\text{NiCl}_4]^{2-}$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Ni}(\text{CO})_4]$, $[\text{CoF}_6]^{3-}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Mn}(\text{CN})_6]^{3-}$, $[\text{Ti}(\text{CN})_6]^{3-}$, $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$

[JEE Main 2026 (Online) 8th April Evening Shift]

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Q.24 The total number of unpaired electrons present in the d^3 , d^4 (low spin) d^5 (high spin), d^6 (high spin) and d^7 (low spin) octahedral complex systems is _____.

[JEE Main 2026 (Online) 5th April Evening Shift]

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- Q.25** The number of isoelectronic species among Sc^{3+} , Cr^{2+} , Mn^{3+} , Co^{3+} and Fe^{3+} is 'n'. If 'n' moles of AgCl is formed during the reaction of complex with formula $\text{CoCl}_3(\text{en})_2\text{NH}_3$ with excess of AgNO_3 solution, then the number of electrons present in the t_{2g} orbital of the complex is _____.

[JEE Main 2026 (Online) 28th January Evening Shift]

Scan or tap for the
full solution



- Q.26** The crystal field stabilisation energy of $[\text{Co}(\text{oxalate})_3]^{3-}$ complex is 'n' times that of the $[\text{Cr}(\text{oxalate})_3]^{3-}$ complex. Here 'n' is _____. (Assume $\Delta_o \gg P$)

[JEE Main 2026 (Online) 23rd January Morning Shift]

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full solution



- Q.27** Identify the metal ions among Co^{2+} , Ni^{2+} , Fe^{2+} , V^{3+} and Ti^{2+} having a spin-only magnetic moment value more than 3.0 BM. The sum of unpaired electrons present in the high spin octahedral complexes formed by those metal ions is _____.

[JEE Main 2026 (Online) 21st January Evening Shift]

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full solution



- Q.28** A transition metal (M) among Mn, Cr, Co and Fe has the highest standard electrode potential (M^{3+}/M^{2+}). It forms a metal complex of the type $[\text{M}(\text{CN})_6]^{4-}$. The number of electrons present in the e_g orbital of the complex is _____.

[JEE Main 2025 (Online) 2nd April Morning Shift]

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ANSWER KEY

Section A (MCQ) — 22 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	3	1	1	1	4	3	4	1	2	2	1
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	2	1	4	1	1	3	3	3	1	1	1

Section B (Numerical) — 6 questions

Ques.	23	24	25	26	27	28					
Ans.	6	15	6	2	7	1					