

JEE MAIN D- AND F-BLOCK ELEMENTS — PYQS

Max. Marks: 168

Questions: 42

Section A (MCQ) — 33 questions

Q.1 Given below are two statements :

Statement-I: The number of pairs among $[\text{Ti}^{4+}, \text{V}^{2+}]$, $[\text{V}^{2+}, \text{Mn}^{2+}]$, $[\text{Mn}^{2+}, \text{Fe}^{3+}]$ and $[\text{V}^{2+}, \text{Cr}^{2+}]$ in which both ions are coloured is 3.

Statement-II: The number of pairs among $[\text{La}^{3+}, \text{Yb}^{2+}]$, $[\text{Lu}^{3+}, \text{Ce}^{4+}]$ and $[\text{Ac}^{3+}, \text{Lr}^{3+}]$ ions in which both are diamagnetic is 3.

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

[JEE Main 2026 (Online) 8th April Evening 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.2 Given below are two statements for catalytic properties of transition metals.

Statement-I: First row transition metals which act as catalyst utilise their 3d electrons only for formation of bonds between reactant molecules and atoms on the surface of catalyst.

Statement-II: There is increase in the concentration of reactants on the surface of catalyst which strengthens the bonds in reacting molecules.

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

[JEE Main 2026 (Online) 8th April Evening 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.3 The correct statements among the following are :

- A. Basic vanadium oxide is used in the manufacture of H_2SO_4 .
- B. The spin-only magnetic moment value of the transition metal halide employed in

Ziegler-Natta polymerization is 2.84 BM.

- C. The p-block metal compound employed in Ziegler-Natta polymerization has the metal in +3 oxidation state.
- D. The number of electrons present in the outer most 'd' orbital of metal halide employed in Wacker process is 8.

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

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

 Scan or tap for the
full solution
Q.4 The correct order of first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionisation enthalpy values of Cr and Mn are :

- A. $\Delta_i H_1 : \text{Cr} > \text{Mn}$
- B. $\Delta_i H_2 : \text{Cr} > \text{Mn}$
- C. $\Delta_i H_1 : \text{Mn} > \text{Cr}$
- D. $\Delta_i H_2 : \text{Mn} > \text{Cr}$

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

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

 Scan or tap for the
full solution


Q.5 Which of the following is NOT a physical or chemical characteristics of interstitial compounds?

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

- (1) They have high melting points, higher than those of pure metals.
- (2) They are very soft and ionic in nature.
- (3) They retain metallic conductivity.
- (4) They are chemically inert and usually non-stoichiometric.

 Scan or tap for the
full solution


Q.6 Given below are two statements :

Statement-I: Presence of large number of unpaired electrons in transition metal atoms results in higher enthalpies of their atomisation.

Statement-II: $d_{xy} = d_{xz} = d_{yz} < d_{x^2-y^2} = d_{z^2}$ and $d_{x^2-y^2} = d_{z^2} < d_{xy} = d_{xz} = d_{yz}$ are the d-orbital splittings in $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{Ni}(\text{Cl})_4]^{2-}$ complex ions respectively.

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

[JEE Main 2026 (Online) 5th April Evening 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.7** The correct statements among the following are,
 A. Mo(VI) and W(VI) are less stable than Cr(VI).
 B. Ce^{4+} and Tb^{4+} are oxidant while Eu^{2+} and Yb^{2+} are reductant.
 C. Cm and Am have seven unpaired electrons.
 D. Actinoid contraction is greater from element to element than lanthanoid contraction.

Choose the correct answer from the options given below : [JEE Main 2026 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



- Q.8** Correct statements from the following are
 A. Potassium dichromate is an oxidising agent and it oxidises FeSO_4 to $\text{Fe}_2(\text{SO}_4)_3$ in acidic medium.
 B. Sodium dichromate can be used as primary standard in volumetric estimation.
 C. CrO_4^{2-} and $\text{Cr}_2\text{O}_7^{2-}$ are interconvertible in aqueous solution by varying the pH of the solution.
 D. Cr–O–Cr bond angle in $\text{Cr}_2\text{O}_7^{2-}$ is 126° .

Choose the correct answer from the options given below : [JEE Main 2026 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



- Q.9** Match the LIST-I with LIST-II

Complex ion		Calculated spin only magnetic moment (BM)	
A.	$[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$	I.	3.87
B.	$[\text{Co}(\text{H}_2\text{O})_6]^{2+}$	II.	5.92
C.	$[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$	III.	4.90
D.	$[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$	IV.	1.73

Choose the correct answer from the options given below : [JEE Main 2026 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



- Q.10** Pairs of elements with the same number of electrons in their respective 4f orbital are
 [Atomic number. Eu-63, Gd-64, Dy-66, Ho-67, Tm-69, Yb-70, Lu-71, Hf-72]

- A. (Eu and Gd) B. (Dy and Ho)
 C. (Yb and Hf) D. (Lu and Tm)

Choose the correct answer from the options given below : [JEE Main 2026 (Online) 4th April Evening Shift]

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

Scan or tap for the full solution



- Q.11** Consider $|x|$ is the difference in oxidation states of Mn in highest manganese fluoride and highest manganese oxide. The ions with $|x|$ number of unpaired electrons from the following are :

- A. Sc^{3+} B. Zn^{2+}
 C. V^{2+} D. Fe^{2+}
 E. Co^{2+}

Choose the correct answer from the options given below : [JEE Main 2026 (Online) 4th April Evening Shift]

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

Scan or tap for the full solution



- Q.12** Which of the following sets includes all the species that will change the orange colour of $\text{K}_2\text{Cr}_2\text{O}_7$ in acidic medium ?

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

- (1) Fe^{2+} , Sn^{2+} , I^- , S^{2-}
 (2) S^{2-} , Fe^{3+} , I^- , $\text{C}_2\text{O}_4^{2-}$
 (3) Fe^{2+} , NO_2^- , SO_2 , Sn^{4+}
 (4) Fe^{3+} , SO_4^{2-} , S^{2-} , Sn^{4+}

Scan or tap for the full solution



- Q.13** Given below are two statements :

Statement-I: Among Zn, Mn, Sc and Cu, the energy required to remove the third valence electron is highest for Zn and lowest for Sc.

Statement-II: The correct order of the following complexes in terms of CFSE is $[\text{Co}(\text{H}_2\text{O})_6]^{2+} < [\text{Co}(\text{H}_2\text{O})_6]^{3+} < [\text{Co}(\text{en})_3]^{3+}$.

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

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

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

Scan or tap for the full solution



Q.14 Among Fe^{2+} , Fe^{3+} , Cr^{2+} and Zn^{2+} , the ion that shows positive borax bead test and with highest ionisation enthalpy is :

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

- (1) Fe^{2+} (2) Zn^{2+} (3) Cr^{2+} (4) Fe^{3+}

Scan or tap for the full solution



Q.15 Given below are two statements :

Statement-I: The number of pairs, from the following, in which both the ions are coloured in aqueous solution is 3.

$[\text{Sc}^{3+}, \text{Ti}^{3+}]$, $[\text{Mn}^{2+}, \text{Cr}^{2+}]$, $[\text{Cu}^{2+}, \text{Zn}^{2+}]$ and $[\text{Ni}^{2+}, \text{Ti}^{4+}]$

Statement-II: Th^{4+} is the strongest reducing agent among Th^{4+} , Ce^{4+} , Gd^{3+} and Eu^{2+} .

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

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

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

Scan or tap for the full solution



Q.16 Consider the following statements about manganate and permanganate ions. Identify the **correct** statements.

- A. The geometry of both manganate and permanganate ions is tetrahedral.
B. The oxidation states of Mn in manganate and permanganate are +7 and +6, respectively.
C. Oxidation of Mn(II) salt by peroxodisulphate gives manganate ion as the final product.
D. Manganate ion is paramagnetic and permanganate ion is diamagnetic.
E. Acidified permanganate ion reduces oxalate, nitrite and iodide ions.

Choose the **correct** answer from the options given below :

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

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

Scan or tap for the full solution



Q.17 "X" is an oxoanion of the lightest element of group 7 (in the periodic table). The metal is in +6 oxidation state in "X". The color of the potassium salt of X is

[JEE Main 2026 (Online) 24th January Evening Shift]

- (1) purple (2) orange (3) yellow (4) green

Scan or tap for the full solution



Q.18 The oxidation state of chromium in the final product formed in the reaction between KI and acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution is :

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

- (1) +2 (2) +3 (3) +4 (4) +6

Scan or tap for the full solution



Q.19 Given below are two statements :

Statement-I: The first ionization enthalpy of Cr is lower than that of Mn.

Statement-II: The second and third ionization enthalpies of Cr are higher than those of Mn.

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

[JEE Main 2026 (Online) 22nd 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.20 MnO_4^{2-} , in acidic medium, disproportionates to :

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

- (1) MnO_4^- and MnO (2) MnO_4^- and MnO_2
(3) Mn_2O_7 and MnO_2 (4) Mn_2O_7 and MnO

Scan or tap for the full solution



Q.21 Given below are some of the statements about Mn and Mn_2O_7 . Identify the correct statements.

- A. Mn forms the oxide Mn_2O_7 , in which Mn is in its highest oxidation state.
B. Oxygen stabilizes the Mn in higher oxidation states by forming multiple bonds with Mn.
C. Mn_2O_7 is an ionic oxide.
D. The structure of Mn_2O_7 consists of one bridged oxygen.

Choose the **correct** answer from the options given below :

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

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

Scan or tap for the full solution



Q.22 The correct decreasing order of spin only magnetic moment values (BM) of Cu^+ , Cu^{2+} , Cr^{2+} and Cr^{3+} ions is :

[JEE Main 2025 (Online) 8th April Evening Shift]

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

Scan or tap for the
full solution



Q.23 The first transition series metal 'M' has the highest enthalpy of atomisation in its series. One of its aquated ions (M^{n+}) exists in green colour. The nature of the oxide formed by the above M^{n+} ion is:

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

- (1) basic (2) neutral
 (3) amphoteric (4) acidic

Scan or tap for the
full solution



Q.24 The number of valence electrons present in the metal among Cr, Co, Fe and Ni which has the lowest enthalpy of atomisation is :

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

- (1) 10 (2) 6 (3) 9 (4) 8

Scan or tap for the
full solution



Q.25 'X' is the number of acidic oxides among VO_2 , V_2O_3 , CrO_3 , V_2O_5 and Mn_2O_7 . The primary valency of cobalt in $[\text{Co}(\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2)_3](\text{SO}_4)_3$ is Y. The value of $X + Y$ is _____.

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

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

Scan or tap for the
full solution



Q.26 Pair of transition metal ions having the same number of unpaired electrons is

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

- (1) Ti^{3+} , Mn^{2+} (2) Ti^{2+} , Co^{2+}
 (3) Fe^{3+} , Cr^{2+} (4) V^{2+} , Co^{2+}

Scan or tap for the
full solution



Q.27 The incorrect relationship in the following pairs in relation to ionisation enthalpies is :

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

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

Scan or tap for the
full solution



Q.28 The metal ions that have the calculated spin-only magnetic moment value of 4.9 B.M. are :

- A. Cr^{2+} B. Fe^{2+}
 C. Fe^{3+} D. Co^{2+}
 E. Mn^{3+}

Choose the correct answer from the options given below: [JEE Main 2025 (Online) 3rd April Morning Shift]

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

Scan or tap for the
full solution



Q.29 Given below are two statements:

Statement-I: CrO_3 is a stronger oxidizing agent than MoO_3

Statement-II: Cr(VI) is more stable than Mo(VI)

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

[JEE Main 2025 (Online) 3rd April 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.30 The correct option with order of melting points of the pairs (Mn, Fe), (Tc, Ru) and (Re, Os) is :

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

- (1) $\text{Fe} < \text{Mn}$, $\text{Ru} < \text{Tc}$ and $\text{Re} < \text{Os}$
 (2) $\text{Fe} < \text{Mn}$, $\text{Ru} < \text{Tc}$ and $\text{Os} < \text{Re}$
 (3) $\text{Mn} < \text{Fe}$, $\text{Tc} < \text{Ru}$ and $\text{Re} < \text{Os}$
 (4) $\text{Mn} < \text{Fe}$, $\text{Tc} < \text{Ru}$ and $\text{Os} < \text{Re}$

Scan or tap for the
full solution



Q.31 Consider 'n' is the number of lone pair of electrons present in the equatorial position of the most stable structure of ClF_3 . The ions from the following with 'n' number of unpaired electrons are

- A. V^{3+} B. Ti^{3+}
 C. Cu^{2+} D. Ni^{2+}
 E. Ti^{2+}

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 28th January Morning Shift]

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

Scan or tap for the
full solution



Q.32 Which of the following oxidation reactions are carried out by both $\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4 in acidic medium?

- A. $\text{I}^- \longrightarrow \text{I}_2$ B. $\text{S}^{2-} \longrightarrow \text{S}$
 C. $\text{Fe}^{2+} \longrightarrow \text{Fe}^{3+}$ D. $\text{I}^- \longrightarrow \text{IO}_3^-$
 E. $\text{S}_2\text{O}_3^{2-} \longrightarrow \text{SO}_4^{2-}$

Choose the correct answer from the options given below :

[JEE Main 2025 (Online) 28th January Morning Shift]

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

Scan or tap for the full solution



Q.33 The amphoteric oxide among V_2O_3 , V_2O_4 and V_2O_5 , upon reaction with alkali leads to formation of an oxide anion. The oxidation state of V in the oxide anion is :

[JEE Main 2025 (Online) 28th January Evening Shift]

- (1) + 4 (2) + 5 (3) + 3 (4) + 7

Scan or tap for the full solution



Section B (Numerical) — 9 questions

Q.34 Number of paramagnetic ions among the following d- and f-block metal ions is _____.

Mn^{2+} , Cu^{2+} , Zn^{2+} , Yb^{2+} , Sc^{3+} , La^{3+} , Gd^{3+} , Lu^{3+} , Ti^{4+} , Ce^{4+}

(Atomic number of Mn = 25, Cu = 29, Zn = 30, Yb = 70, Sc = 21, La = 57, Gd = 64, Lu = 71, Ti = 22, Ce = 58) [JEE Main 2026 (Online) 2nd April Evening Shift]

Scan or tap for the full solution



Q.35 Among the following oxides of 3d elements, the number of mixed oxides are _____.

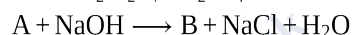
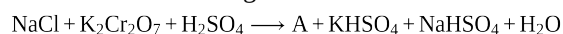
Ti_2O_3 , V_2O_4 , Cr_2O_3 , Mn_3O_4 , Fe_3O_4 , Fe_2O_3 , Co_3O_4

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

Scan or tap for the full solution



Q.36 Consider the following reactions :



In the product 'C', 'X' is the number of O_2^{2-} units, 'Y' is the total number of oxygen atoms present and 'Z' is the oxidation state of Cr. The value of $X + Y + Z$ is _____.

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

Scan or tap for the full solution



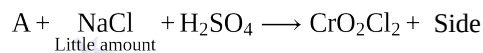
Q.37 $KMnO_4$ acts as an oxidising agent in acidic medium. 'X' is the difference between the oxidation states of Mn in reactant and product. 'Y' is the number of 'd' electrons present in the brown red precipitate formed at the end of the acetate ion test with neutral ferric chloride. The value of $X + Y$ is _____.

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

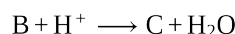
Scan or tap for the full solution



Q.38 Consider the following reactions



Products



The number of terminal 'O' present in the compound 'C' is _____

[JEE Main 2025 (Online) 3rd April Morning Shift]

Scan or tap for the full solution



Q.39 Among Sc, Mn, Co and Cu, identify the element with highest enthalpy of atomisation. The spin only magnetic moment value of that element in its +2 oxidation state is _____ BM (in nearest integer).

[JEE Main 2025 (Online) 3rd April Evening Shift]

Scan or tap for the full solution



Q.40 The spin-only magnetic moment value of M^{n+} ion formed among Ni, Zn, Mn and Cu that has the least enthalpy of atomisation is _____. (in nearest integer) Here n is equal to the number of diamagnetic complexes among $K_2[NiCl_4]$, $[Zn(H_2O)_6]Cl_2$, $K_3[Mn(CN)_6]$ and $[Cu(PPh_3)_3]I$

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

Scan or tap for the full solution



Q.41 The molar mass of the water insoluble product formed from the fusion of chromite ore ($FeCr_2O_4$) with Na_2CO_3 in presence of O_2 is _____ $g\ mol^{-1}$.

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

Scan or tap for the full solution



Q.42 The spin only magnetic moment (μ) value (B.M.) of the compound with the strongest oxidising power among Mn_2O_3 , TiO and VO is _____ B.M. (Nearest integer).

[JEE Main 2025 (Online) 28th January Evening Shift]

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ANSWER KEY

Section A (MCQ) — 33 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	1	2	3	2	2	1	3	2	4	4	3
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	1	1	4	2	1	4	2	1	2	2	3
Ques.	23	24	25	26	27	28	29	30	31	32	33
Ans.	1	2	4	4	1	2	1	4	2	1	2

Section B (Numerical) — 9 questions

Ques.	34	35	36	37	38	39	40
Ans.	3	3	13	10	6	4	0
Ques.	41	42					
Ans.	160	5					