



WEIRD CHEMIST

d-Block Elements

Magnetic Nature, Complex Formation, Colour,
Interstitial Compounds

DPP – 06

Topic: Properties of TM

Questions: 61 Questions

Exam: NEET / JEE

▶ TYPE 1 : Magnetic Nature

Q1. The value of magnetic moment in Bohr magneton for a transition metal of 3d series is $\sqrt{48}$. Its electronic configuration is [NCERT Pg. 228]

Ar $3d^5 4s^2$
Ar $3d^6 4s^2$

Ar $3d^5 4s^1$
Ar $3d^1 4s^2$

Q2. The correct match of the order of the ions/elements for the given properties is/are [NCERT Pg. 235, 220, 228]

- (i) $\text{Mn}^{2+} < \text{Fe}^{2+} < \text{Co}^{2+} < \text{Ni}^{2+}$ – Magnitude of hydration enthalpy
(ii) $\text{Co} > \text{Ni} > \text{Fe} > \text{Mn}$ – Atomic radii
(iii) $\text{Ni}^{2+} < \text{Co}^{2+} < \text{Fe}^{2+} < \text{Mn}^{2+}$ – Number of unpaired electrons

- (1) Only (iii)
(2) Both (i) and (ii)
(3) Both (i) and (iii)
(4) (i), (ii) and (iii)

Q3. The highest magnetic moment will be shown by

- (1) Zn (2) Co (3) Mn (4) Fe

Q4. The highest magnetic moment will be shown by

Same as Q.49.

- (1) Zn (2) Co (3) Mn (4) Fe

Q5. Magnetic moment 2.83 BM is given by which of the following ions? (At. nos. Ti = 22, Cr = 24, Mn = 25, Ni = 28) [AIPMT-2014]

- (1) Ti^{3+} (2) Ni^{2+} (3) Cr^{3+} (4) Mn^{2+}

Q6. Magnetic moment of Cr^{2+} , Mn^{2+} and Fe^{2+} are x, y, z. They are in order

- (1) $x < y < z$ (2) $x > y > z$ (3) $z < x = y$ (4) $x = z < y$

Q7. The spin only magnetic moment of Fe^{3+} ion in (BM) is approximately.

- (1) 4 (2) 7 (3) 5 (4) 6

Q8. Which of the following pair of ions has same value of “spin-only” magnetic moment

- (1) Cu^+ , Cu^{2+} (2) Co^{3+} , Fe^{2+} (3) Ti^{2+} , V^{2+} (4) Sc^{2+} , Zn^{2+}

Q9. Value of magnetic moment of a divalent metal ion is 5.92 BM. Total number of electrons in its atom would be

- (1) 24 (2) 25 (3) 26 (4) 27

Q10. Which of the following pair of ions have same value of “spin-only” magnetic moment?

- (1) Cu^+ , Cu^{2+} (2) Co^{3+} , Fe^{2+} (3) Ti^{2+} , V^{2+} (4) Sc^{2+} , Zn^{2+}

Q11. The magnetic moment of a divalent ion in aqueous solution if its atomic number is 25 is–

- (1) 4.9 B.M (2) 5.92 BM (3) 3.8 B.M (4) 2.8 B.M

Q12. Match the column

Ions	Magnetic moment (BM)
A. Ti^{2+}	i. 3.87 BM
B. Ni^{3+}	ii. 0 BM
C. Zn^{2+}	iii. 2.83 BM
D. Sc^{2+}	iv. 1.73 BM

- (1) A–i; B–ii; C–iii; D–iv
 (2) A–iv; B–iii; C–ii; D–i
 (3) A–iii; B–i; C–ii; D–iv
 (4) A–i; B–iii; C–iv; D–ii

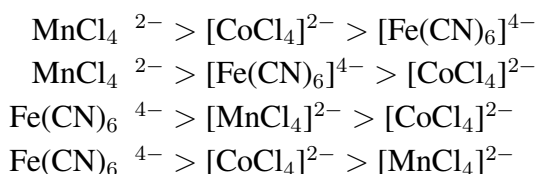
Q13. Which of the following transition metal ion has magnetic moment 3.87 BM?

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

Q14. In which of the following compounds does the transition metal ion have 4.90 BM magnetic moment?

- (1) KMnO_4 (2) NiCl_2 (3) CoCl_2 (4) FeSO_4

Q15. Correct order of theoretical value of magnetic moment



Q16. What is the value of magnetic moment of the central metal ion in K_2MnO_4 ?

- (1) 0.0 BM (2) 1.73 BM (3) 2.83 BM (4) 3.87 BM

Q17. Which of the following is the correct order of magnetic moment (in BM) of Mn^{2+} , Cr^{2+} and V^{2+}

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

Q18. The highest magnetic moment is shown by the transition metal ion with the outermost electronic configuration:

- (1) $3d^5$ (2) $3d^2$ (3) $3d^7$ (4) $3d^9$

Q19. Match the columns

Column-I (Ion)	Column-II ($M_{\text{calculated}}$)
(A) Ti^{2+}	(p) 2.84
(B) Zn^{2+}	(q) 5.92
(C) Mn^{2+}	(r) 0
(D) Sc^{3+}	(s) 4.90

- (1) A – s; B – p; C – q; D – r
 (2) A – r; B – p; C – q; D – s
 (3) A – p; B – r; C – q; D – r
 (4) A – p; B – s; C – q; D – r

Q20. The chloro compound of vanadium has only spin magnetic moment of 1.73 BM. This vanadium chloride has the formula:– (at. no. of V = 23)

- (1) VCl_4 (2) VCl_3 (3) VCl_2 (4) VCl_5

Q21. Arrange the following ions in order of their magnetic moment:–

- (i) V^{4+} (ii) Mn^{4+} (iii) Fe^{3+} (iv) Ni^{2+}

(Atomic number of V = 23, Mn = 25, Fe = 26, Ni = 28)

- (1) (ii) > (iii) > (i) > (iv)
(2) (iii) > (ii) > (iv) > (i)
(3) (i) > (iv) > (iii) > (ii)
(4) (iv) > (iii) > (i) > (ii)

Q22. A metal ion from the first transition series has a magnetic moment (calculated) of 3.87 B.M. How many unpaired electrons are expected to be present in the ion?

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

Q23. Transition metals show paramagnetism:

- (1) Due to characteristic configuration (3) Due to variable oxidation states
(2) High lattice energy (4) Due to unpaired electrons

Q24. The maximum number of unpaired electrons are in

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

Q25. Which of the following has the maximum number of unpaired d electrons?

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

► TYPE 2 : Complex Formation

Q26. The transition metals form a large number of complex compounds due to

[NCERT Pg. 229]

- (1) Their lower ionic charges
(2) Availability of f -orbitals for bond formation
(3) Their inability to adopt multiple oxidation states
(4) Smaller size of metal ions

Q27. The tendency to form complexes is maximum for

- (1) Inner-transition elements
- (2) Representative elements
- (3) Transition elements
- (4) Metals containing fully filled d -orbitals

Q28. How many statements are true for transition metals.

- (a) They form complex compounds
 - (b) They show variable oxidation state
 - (c) Their ions are colourless
 - (d) Their ions contain partially filled d -orbitals
- (1) 1 (2) 2 (3) 3 (4) 4

Q29. Statement-A: Transition metals are highly reactive.

Statement-B: Transition metals show variable oxidation state.

Statement-C: Transition metals have low m.p.

Statement-D: Transition metals are highly electropositive.

Which of the following statements are incorrect?

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

Q30. Which of the following sentences is not suitable for the capacity of transition metals to form complex compounds?

- (1) Transition metal ions are small in size.
- (2) Nuclear charge of transition metal ion is comparatively more.
- (3) Co-ordination covalent bond is not directional.
- (4) Transition metal ions possess different oxidation states.

Q31. Transition elements make complex compounds due to–

- (1) Presence of empty orbital
- (2) Large size
- (3) Variable valency
- (4) Presence of $2e^-$

▶ TYPE 3 : Colour

Q32. Which of the following ions can show $d-d$ transition?

- (1) CrO_4^{2-} (2) $\text{Cr}_2\text{O}_7^{2-}$ (3) MnO_4^{2-} (4) MnO_4^-

Q33. Which of the following pairs of ions are coloured in aqueous solution?

- (1) Ni^{2+} & Ti^{3+} (2) Sc^{3+} & Ti^{3+} (3) Ni^{2+} & Sc^{3+} (4) Sc^{3+} & Cu^+

Q34. Which of the following ions will exhibit colour in aqueous solutions?

[AIPMT

(Prelims)-2010]

- (1) La^{3+} ($Z = 57$) (2) Ti^{3+} ($Z = 22$) (3) Lu^{3+} ($Z = 71$) (4) Sc^{3+} ($Z = 21$)

Q35. In which of the following pairs are both the ions coloured in aqueous solution? (At. no.: Sc = 21, Ti = 22, Ni = 28, Cu = 29, Co = 27)

[AIPMT (Prelims)-2006]

- (1) Ni^{2+} , Ti^{3+} (2) Sc^{3+} , Ti^{3+} (3) Sc^{3+} , Co^{2+} (4) Ni^{2+} , Cu^+

Q36. The aqueous solution containing which one of the following ions will be colourless? (Atomic no. Sc = 21, Fe = 26, Ti = 22, Mn = 25)

[AIPMT (Prelims)-2005]

- (1) Sc^{3+} (2) Fe^{2+} (3) Ti^{3+} (4) Mn^{2+}

Q37. Which ion is colourless?

- (1) Cr^{4+} (2) Sc^{3+} (3) Ti^{3+} (4) V^{3+}

Q38. Which of the following is expected to be coloured in solutions?

- (1) Cu^+ (2) Cu^{2+} (3) Ti^{4+} (4) Sc^{3+}

Q39. Among the following, the coloured compound is

- (1) CuCl (2) $\text{K}_3[\text{Cu}(\text{CN})_4]$ (3) $\text{CuF}_2 \cdot x\text{H}_2\text{O}$ (4) $\text{Cu}(\text{CH}_3\text{CN})_4 \text{BF}_4$

Q40. Which of the following is not coloured?

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

Q41. In which of the following metal ions does the frequency of light absorbed lie in the visible region?

- (1) Sc^{3+} (2) Cu^+ (3) Cd^{2+} (4) Cr^{3+}

Q42. Which of the following metal ions is colourless?

- (1) Ti^{4+} , Cu^{2+}
 (2) Ti^{4+} , Cu^{+1}

- (3) Cr^{2+} , Cu^{+}
 (4) Ti^{4+} , Mn^{3+}

Q43. Match column-A and B

Column-A	Column-B
1. V^{4+}	a. Colourless
2. Ti^{3+}	b. Pink
3. Ti^{4+}	c. Purple
4. Mn^{2+}	d. Blue
	e. Violet

- (1) 1-d; 2-c; 3-a; 4-e
 (2) 1-d; 2-c; 3-a; 4-b
 (3) 1-d; 2-c; 3-e; 4-b
 (4) 1-e; 2-c; 3-b; 4-a

Q44. Which group of ions has coloured ions?

1. Cu^{+} 2. Ti^{4+} 3. Co^{2+} 4. Fe^{2+}

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

Q45. Mention the colourless pair from $[\text{TiF}_6]^{2-}$, $[\text{CoF}_6]^{3-}$, Cu_2Cl_2 and $[\text{NiCl}_4]^{2-}$

Formulas standardised from the scanned copy: “ Ca_2Cl_2 ” read as Cu_2Cl_2 (matches the species named in the question stem), and the garbled “ $[\text{TiFe}]^{2-}$ ”/“ $[\text{COF}_6]^{3-}$ ” in option (3) read as $[\text{TiF}_6]^{2-}$ /“ $[\text{CoF}_6]^{3-}$ ”.

TiF_6^{2-} and Cu_2Cl_2
 CoF_6^{3-} and $[\text{NiCl}_4]^{2-}$

TiF_6^{2-} and $[\text{CoF}_6]^{3-}$
 (1) Cu_2Cl_2 and $[\text{NiCl}_4]^{2-}$

Q46. Which of the following compounds is coloured?

- (1) TiCl_3 (2) FeCl_3 (3) CoCl_3 (4) All above

Q47. Which of the following ions cannot show d-d transition?

- (1) Ti^{4+} (2) Cr^{3+} (3) Mn^{2+} (4) Cu^{2+}

Q48. Which of the following compounds is expected to be coloured?

- (1) Ag_2SO_4 (2) CuF_2 (3) MgF_2 (4) CuCl

Q49. The ions from among the following which are colourless are.

- (a) Ti^{4+} (b) Cu^{+1} (c) Co^{+3} (d) Fe^{2+}

- (1) a and b only (2) a, b and c (3) c and d only (4) b and c only

Q50. Which pair of ions is colourless:–

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

Q51. Which group contains coloured ions out of:

1. Cu^{+} 2. Ti^{4+} 3. Co^{2+} 4. Fe^{2+}

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

Q52. The following ion in its aqueous solution is colourless:

- (1) Sc^{+3} (2) Fe^{2+} (3) Ti^{3+} (4) Mn^{2+}

Q53. Which of the ions will give a colourless aqueous solution?

- (1) Ni^{2+} (2) Fe^{2+} (3) Cu^{2+} (4) Cu^{+}

Q54. Which of the following metal ions is expected to be coloured:–

- (1) Zn^{+2} (2) Ti^{+3} (3) Sc^{+3} (4) Ti^{+4}

► TYPE 4 : Interstitial Compounds

Q55. Which of the following statements about the interstitial compounds is incorrect? [NEET-2013]

- (1) They are chemically reactive
(2) They are much harder than the pure metal
(3) They have higher melting points than the pure metal
(4) They retain metallic conductivity

Q56. Which of the following forms interstitial compounds?

- (1) Fe (2) Co (3) Ni (4) All of these

Q57. Which among the following pairs is of interstitial compounds?

- (1) SiH_4 , LiH (3) Al_4C_3 , SiC
(2) Fe_3H , Mn_4N (4) TiCl_4 , MnO_2

Q58. Which of the following statements regarding interstitial compounds is incorrect?

- (1) They are chemically inert
- (2) They are soft and nonconductive
- (3) They retain metallic conductivity
- (4) They have high melting point.

Q59. Statement-A: Interstitial compounds make the metal more soft.

Statement-B: They make the metal more ductile.

Statement-C: They make the metal more metallic.

Statement-D: They make the metal more hard.

Which of the following statements are wrong?

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

Q60. Which forms interstitial compounds?

Same as Q.103.

- (1) Fe
- (2) Co
- (3) Ni
- (4) All

Q61. Interstitial compounds are formed when small atoms are trapped inside the crystal lattice of metals. Which of the following is not a characteristic property of interstitial compounds?

- (1) They have high melting points in comparison to pure metals.
- (2) They are very hard
- (3) They retain metallic conductivity
- (4) They are chemically very reactive