

13. TRANSITION ELEMENTS AND LANTHANIDES

PREVIOUS EAMCET BITS

1. Which one of the following sets correctly represent the increase in the paramagnetic property of the ion ? [EAMCET 2009 E]

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

Ans: 1

Sol: Number of unpaired electrons $\text{Cu}^{2+} = 1$ $\text{V}^{2+} = 3$ $\text{Cr}^{2+} = 4$ $\text{Mn}^{2+} = 5$

$$\mu_s = \sqrt{n(n-2)}$$

As the number of unpaired electron increases paramagnetism increases

2. Which one of the following pairs of complexes has the effect atomic number equal to 36 for the transition element? [EAMCET 2008 M]

- 1) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3, \text{K}_3[\text{Fe}(\text{CN})_6]$ 2) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3, [\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$
 3) $[\text{Fe}(\text{CO})_5], \text{K}_4[\text{Fe}(\text{CN})_6]$ 4) $[\text{Fe}(\text{CO})_5], \text{K}_3[\text{Fe}(\text{CN})_6]$

Ans: 3

Sol: $[\text{Fe}(\text{CO})_5]$ EAN = 26 + 10 = 36

$$\text{K}_4[\text{Fe}(\text{CN})_6] \text{ EAN} = 26 - 2 + 12 = 36$$

3. When AgNO_3 solution is added in excess to 1 M solution of $\text{CoCl}_3 \cdot \text{XNH}_3$ one mole of AgCl is formed. What is the value of X [EAMCET 2007 M]

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

Ans: 4

Sol: $\text{CoCl}_3 \cdot \text{XNH}_3$ give 1 mole of AgCl . So one Cl^- ion is outside the complex. So 2Cl^- and 4NH_3 satisfy coordination number 6.

4. Which of the following is a Ferrous alloy [EAMCET 2006 M]

- 1) German silver 2) Gunmetal 3) Nichrome 4) Devard's alloy

Ans: 3

Sol: Nichrome

Ni - Cr steel \rightarrow 60%

Fe - 25%

Cr = 15%

5. How many 'd' electrons are in present Cr^{2+} ion [EAMCET 2002 M]

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

Ans: 1

Sol: $\text{Cr}^{2+} = [\text{Ar}]4s^0 3d^4$

1	1	1	1	
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Number of 'd' electron are 4.

6. Which one of the following is a diamagnetic ion ? [EAMCET 2001 M]

- 1) CO^{2+} 2) Cu^{2+} 3) Mn^{2+} 4) Sc^{3+}

Ans: 4

Sol: The ion with no unpaired electron acts as diamagnetic ion. Sc^{3+} ion as no unpaired electrons therefore it acts as diamagnetic ion.

$$\text{Sc}^{3+} = [\text{Ar}]3d^0 4s^0$$

7. Which one of the following ions exhibits colour in aqueous solution [EAMCET 2000 M]

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

Ans: 2

Sol: Sc^{3+} , Ti^{4+} and Zn^{2+} don't have unpaired electrons. But Ni^{2+} has two unpaired electrons. Therefore it is coloured.

8. $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$ and $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$ are a pair of isomers [EAMCET 2008 E]

- 1) ionisation 2) ligand 3) coordination 4) hydrate

Ans: 1

Sol: $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$ gives Br^- ions in aqueous solution $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$ gives SO_4^{2-} ion in aqueous solution.9. Which of the following pair of transition metal ions, have the same calculated values of magnetic moment? **[EAMCET 2007 E]**

- 1)
- Ti^{2+}
- and
- V^{2+}
- 2)
- Fe^{2+}
- and
- Cu^{2+}
- 3)
- Cr^{2+}
- and
- Fe^{2+}
- 4)
- Co^{2+}
- and
- Ti^{2+}

Ans: 3

Sol: $\text{Co}^{2+} = [\text{Ar}]3d^4$

↑	↑	↑	↑	
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 $\text{Fe}^{2+} = [\text{Ar}]3d^6$

↑↓	↑	↑	↑	↑
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Each have 4 unpaired electrons. Therefore spin only magnetic moment is same

10. What is the correct order of spin only magnetic moment (in BM) of Mn^{2+} , Cr^{2+} and V^{2+} ? **[EAMCET 2006 E]**

- 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)
- $\text{Cr}^{2+} > \text{V}^{2+} > \text{Mn}^{2+}$

Ans: 3

Sol: Spin only magnetic moment = $\sqrt{n(n+2)}\text{B.M}$

n = number of unpaired electrons

Magnetic moment is proportional to number of unpaired electron

 Mn^{2+} has 5 unpaired electron Cr^{2+} has 4 unpaired electron V^{2+} has 2 unpaired electron11. A complex compound of Co^{3+} with molecular formula $\text{CoCl}_x \cdot y\text{NH}_3$ gives a total of 3 ions when dissolved in water. How many Cl^- ions satisfy both the primary and secondary valencies in this complex? **[EAMCET 2005 E]**

- 1) 3 2) 1 3) 4 4) zero

Ans: 2

Sol: In water complex gives only 3 ions. Therefore inside the co-ordination sphere one Cl is present which satisfy both primary and secondary valency.

12. Which of the following pairs of ions are colourless? **[EAMCET 2004 E]**

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

Ans: 2

Sol: $\text{Sc}^{3+} (3d^0)$, $\text{Zn}^{2+} (3d^{10})$ have zero unpaired electron13. Which of the following pairs of ions has same paramagnetic character? **[EAMCET 2004 E]**

- 1)
- Cu^{2+}
- ,
- Ti^{3+}
- 2)
- Mn^{2+}
- ,
- Cu^{2+}
- 3)
- Ti^{4+}
- ,
- Cu^{2+}
- 4)
- Ti^{3+}
- ,
- Ni^{2+}

Ans: 1

Sol: $\text{Cu}^{2+} (3d^9)$ and $\text{Ti}^{3+} (3d^1)$ have one unpaired electron each. So they have same paramagnetic moment.14. Ferrous ion changes to X ion, on reacting with acidified hydrogen peroxide. The number of d-electrons present in X and its magnetic moment (in BM) are, respectively **[EAMCET 2003 E]**

- 1) 6 and 6.93 2) 5 and 5.92 3) 5 and 4.9 4) 4 and 5.92

Ans: 2

Sol: $2\text{Fe}^{2+} + 2\text{H}^+ + \text{H}_2\text{O}_2 \longrightarrow 2\text{Fe}^{3+} + 2\text{H}_2\text{O}$ $\text{Fe}^{3+} = [\text{Ar}] 3d^5$

↑	↑	↑	↑	↑
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$$\mu_s = \sqrt{n(n+2)} = 5.92\text{BM}$$

15. The calculated magnetic moment (in Bohr magnet ones) of Cu^{2+} ion is **[EAMCET 2002 E]**

- 1) 1.73 2) zero 3) 2.6 4) 3.4

Ans: 1

Sol: $\text{Cu}^{2+} = [\text{Ar}]3d^9$

Cu^{2+} has one unpaired electron

$$\mu_s = \sqrt{n(n+2)} = \sqrt{3} = 1.73\text{BM}$$

16. Which one of the following ions exhibits highest magnetic moment? [EAMCET 2001 E]

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

Ans: 4

Sol: As the number of unpaired electron increases magnetic moment increases.

Number of unpaired electron in $\text{Cu}^{2+} = 1$

Number of unpaired electron in $\text{Ti}^{3+} = 1$

Number of unpaired electron in $\text{Ni}^{2+} = 2$

Number of unpaired electron in $\text{Mn}^{2+} = 5$

$\therefore \text{Mn}^{2+}$ has highest magnetic moment.

17. Which of the following ions is colourless in aqueous solution? [EAMCET 2000 E]

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

Ans: 4

Sol: Zn^{2+} has no unpaired electrons. Therefore it is colourless ion.

18. Brass is an alloy of [EAMCET 2000 E]

- 1) Ag and Cu 2) Sn and Zn 3) Cu and Sn 4) Cu and Zn

Ans: 4

Sol: Brass : Cu \rightarrow 60 – 80%

Zn \rightarrow 20 – 40%

