

Daily Tutorial Sheet 1

Level – 1

1.(A) ${}_{26}\text{Fe} = [\text{Ar}] 3d^5 4s^2$; $\text{Fe}^{2+} = [\text{Ar}] 3d^6$

Number of unpaired electrons, $n = 4$

$$\mu = \sqrt{n(n+2)} = \sqrt{4(4+2)} = 4.89$$

2.(A) Usually across the first transition series, the negative values for standard electrode potential decrease except for Mn due to stable d^5 -configuration.

So, correct order: $\text{Mn} > \text{Cr} > \text{Fe} > \text{Co}$

3.(C) The electronic configuration of Mn is

$${}_{25}\text{Mn} = [\text{Ar}] 3d^5 4s^2$$

$$\text{Mn}^{4+} = [\text{Ar}] 3d^3$$

Thus, three unpaired electrons are present.

$$\therefore \text{Spin only magnetic momentum, } \mu = \sqrt{n(n+2)}$$

$$\therefore n = 3 \quad \therefore \mu = \sqrt{3(3+2)} = \sqrt{15} = 3.87 \approx 4 \text{ BM}$$

4.(D) Maximum oxidation state exhibited by d-Block elements (O.S.) = Number of ns electrons + Number of $(n-1)$ d-electrons.

(a) O.S. = $2 + 2 = 4$

(b) O.S. = $5 + 1 = 6$

(c) O.S. = $3 + 2 = 5$

(d) O.S. = $5 + 2 = 7$

$\therefore (n-1)d^5 ns^2$ configuration will achieve the highest oxidation state.

5.(D) Zn^{2+} ions have all paired electrons so, it is diamagnetic.

6.(A) Given, $X = [\text{Ar}] d^4$.

$\therefore$ The complete configuration of the ion,

$$X^{3+} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^4$$

$$\therefore X = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^2$$

$\therefore$ The atomic number of the element is 25 and the element is Mn.

7.(D) In $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$, Mn is present as Mn^{2+} .

$$\text{Mn}^{2+} = \begin{array}{c} 3d^5 \\ \boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow} \end{array} \begin{array}{c} 4s^0 \\ \boxed{} \end{array} \text{ (unpaired electrons = 5)}$$

In $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, Cu is present as Cu^{2+} .

$$\text{Cu}^{2+} = \begin{array}{c} 3d^9 \\ \boxed{\uparrow\downarrow} \boxed{\uparrow\downarrow} \boxed{\uparrow\downarrow} \boxed{\uparrow\downarrow} \boxed{\uparrow} \end{array} \begin{array}{c} 4s^0 \\ \boxed{} \end{array} \text{ (unpaired electrons = 1)}$$

In $\text{FeSO}_4 \cdot 6\text{H}_2\text{O}$, Fe is present as Fe^{2+} .

$$\text{Fe}^{2+} = \begin{array}{c} 3d^6 \\ \boxed{\uparrow\downarrow} \boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow} \end{array} \begin{array}{c} 4s^0 \\ \boxed{} \end{array} \text{ (unpaired electrons = 4)}$$

In $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$, Ni is present as Ni^{2+} .

$$\text{Ni}^{2+} = \begin{array}{c} 3d^8 \\ \boxed{\uparrow\downarrow} \boxed{\uparrow\downarrow} \boxed{\uparrow\downarrow} \boxed{\uparrow} \boxed{\uparrow} \end{array} \begin{array}{c} 4s^0 \\ \boxed{} \end{array} \text{ (unpaired electrons = 2)}$$

Since, paramagnetic character $\propto$ unpaired electrons.

Thus, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ has the lowest degree of paramagnetism among the given compounds at 298 K.

- 8.(D)** Transition metals can form ionic or covalent compounds and their melting and boiling points are high. Their compounds are generally coloured and they usually exhibit variable valency.
- 9.(D)** Elements having electronegativity in the range of 1.35 – 1.82 do not form stable hydride. Thus, leads to hydride gap. These are present in the middle of the Periodic Table, i.e., belong to groups 7, 8 and 9.
- 10.(B)** ${}_{25}\text{Mn} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^5$
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| 1 | 1 | 1 | 1 | 1 |
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- $\therefore$ Number of unpaired electrons in Mn = 5
- $\therefore$ magnetic moment of Mn = $\sqrt{n(n+2)}$
- 11.(C)** In CuF_2 , Cu^{2+} ion exist, having d^9 configuration. Unpaired electron causes colour (d-d transition). In the crystalline form, CuF_2 is blue coloured.
- 12.(A)** When oxyhaemoglobin changes to Haemoglobin, Fe^{2+} ion changes from diamagnetic to paramagnetic.
- 13.(C)** The electronic configuration of mercury (80) is, $[\text{Xe}]4f^{10}, 5d^{10}, 6s^2$. Its d-subshell is completely filled, thus it prevents the overlapping of d-orbitals (d-d overlapping). Hence, it is liquid metal at room temperature.
- 14.(C)** A transition metal ion exists in the highest oxidation state. It is expected to behave as an oxidizing agent.
- 15.(A)** Oxide of Mn in its intermediate oxidation state i.e., +4 is MnO_2 . This is amphoteric in character.