SOLUTION TEST-B

1. MnO_2 on fusion with KNO_3 or alkali gets oxidised to form green colour compound called manganate ion, MnO_4^{2-} or potassium manganate.

$$2MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$$

The correct answer is (ii)

2. In 3d series, zinc has a lowest melting point due to fully filled 3d subshell and weak interatomic forces of attraction.

The correct answer is (iii)

3. $$2MnO_4^- + 5H_2S + 6H^+ \longrightarrow 2Mn^{2+} + \underset{\substack{\text{colloidal}\\\text{sulphur}}}{5S} + 8H_2O$$

The correct answer is (iii)

4. **The correct answer is (i)**

5. The assertion in wrong. $E^o_{Cr^{3+}/Cr^{2+}}$ is actually less then $E^o_{Fe^{3+}/Fe^{2+}}$. Cr^{3+} is more stable than Fe^{3+} due to half-filled t_{2g}^3 configuration in Cr^{3+}.

The correct answer is (iv)

6. Chromate ion CrO_4^{2-} or dichromate ion $Cr_2O_7^{2-}$ or permanganate ion MnO_4^-.

7. Mn^{2+} ion has highest value of the magnetic moment. Mn^{2+} ion has five unpaired electrons, therefore, the magnetic moment $\mu = \sqrt{5(5+2)} = \sqrt{35}$ BM

8. (i) Zr and Hf have a comparable atomic size due to lanthanoide contraction. That's why they both exist together in the earth crust in their minerals.

(ii) Zn, Cd and Hg all have fully filled d^{10} configuration in their ground state as well as in their stable oxidation states. Hence, they are not considered as transition metals.

9. (i) $Lu^{3+} : [Xe]4f^{14}$

$La^{3+} : [Xe]4f^0$

Both these ions have no unpaired electron. Hence, these ions do not show any colour or magnetic properties.

(ii) 5d series elements have a fully filled $4f^{14}$ subshell present. The 4f subshell has a poorest shielding effect and cannot protect the valence electrons effectively form the nucleus. All valence electrons are then strongly attract towards the nucleus. Hence, electrons in all 5d series elements are strongly held by the nucleus and have a higher ionization enthalpy than 3d or 4d series elements.

10. (i) ${}_{28}M^{2+} : [Ar]3d^8$

There are two unpaired electrons , magnetic moment, μ is $\mu = \sqrt{2(2+2)} = \sqrt{8}$ BM

(ii) The order of increasing stability of +3 oxidation state is $Mn^{3+} < Fe^{3+} < Cr^{3+}$

11. (i) Transition metals have a lattice structure in which the unoccupied space is called hole / interstices. Transition metals can entrap small size, highly electronegative elements into these interstices and results in the formation of interstitial compounds. Example is Tungsten carbide.

(ii) Only $E^{o}_{Cu^{2+}/Cu} = +0.34V$ is the positive value due to low hydration enthalpy of Cu^{2+}. This low hydration enthalpy is not able to compensate for high enthalpy of sublimation and enthalpy of ionization.

12. (i) $2MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$

(ii) $2MnO_4^{2-} + 4H^+ \longrightarrow 2MnO_4^- + MnO_2 + 2H_2O$

(iii) $Cr_2O_7^{2-} + 3SO_2 + 2H^+ \longrightarrow 2Cr^{3+} + 3SO_4^{2-} + H_2O$

13. (i) Transition metals all have a lattice structure. Due to their comparable size, one metal can substitute other metal in the crystal lattice and results in the alloy formation. Example is Brass (Copper and Zinc).

(ii) Eu (II) attains a common oxidation of +III of lanthanoids by the loss of one electron. The substance which loses electron is called a reducing agent. Hence, Eu(II) compounds are strongly reducing.

(iii) $E^{o}_{M^{2+}/M}$ values do not follow a regular trend in the 3d series due to irregular trends in the enthalpy of sublimation (or atomisation) and ionization enthalpy.

14. (i) The symbol of the ion or Co^{3+}.

(ii) Transition metals shows their highest oxidation states in oxides and fluorides because fluorine and oxygen are the two most electronegative elements. In addition, oxygen also stabilises highest oxidation states by forming double bonds.

(iii) In 3d series manganese, Mn shows a highest oxidation state of +7 in potassium permangante, $KMnO_4$.

15. (a) A $\rightarrow$ $FeCr_2O_4$

B $\rightarrow$ Na_2CrO_4

C $\rightarrow$ $Na_2Cr_2O_7$

The chemical equations are

(i) $\underset{(A)}{4FeCr_2O_4} + 8Na_2CO_3 + 7O_2 \longrightarrow \underset{(B)}{8Na_2CrO_4} + 2Fe_2O_3 + 8CO_2$

(ii) $\underset{(B)}{2Na_2CrO_4} + H_2SO_4 \longrightarrow \underset{(C)}{Na_2Cr_2O_7} + Na_2SO_4 + H_2O$

(b) $VO_2^+ < CrO_4^{2-} < Cr_2O_7^{2-} < MnO_4^-$

(c) Cupric iodide, CuI_2 is unstable due to intramolecular redox reaction leading to the formation of Cu_2I_2 and I_2

$2CuI_2 \rightarrow Cu_2I_2 + I_2$, $2Cu^{2+} + 4I^- \rightarrow 2Cu^+ + I_2 + 2I^-$.

