## Question 9:

- (i) E° value for the Mn<sup>+3</sup>/Mn<sup>+2</sup> couple is positive (+1.5 V) whereas that of Cr<sup>+3</sup>/Cr<sup>+2</sup> is negative (-0.4 V). Why? '
- (ii) Transition metals form coloured compounds.Why?
- (iii) Complete the following equation:

### Answer:

- (i) Mn<sup>+2</sup> is more stable than Mn<sup>+3</sup> due to half filled d-orbitals (3d5), whereas Cr<sup>+3</sup> is more stable than Cr<sup>+2</sup> due to half filled orbitals.
- (ii) It is due to presence of unpaired electrons which undergo d-d transition by absorbing light from visible region and radiate complementary colour.

(iii) 
$$2MnO_4^- + 16 H^+ + 5C_2O_4^- ---- > 2Mn^{+2} + 8H_2O + 10CO_2$$

# question 10:

- (i) MnO is basic whereas Mn207 is acidic in nature. Why?
- (ii) Transition metals form alloys. Why?
- (iii) Complete the following equation:

$$2MnO_4 + 4KOH + O_2 ---->$$

#### Answer:

- (i) In MnO, Mn has +2 oxidation state, whereas in Mn<sub>2</sub>O<sub>7</sub>, Mn has + 7 oxidation state. Higher the oxidation state, more will be acidic nature, e.g. Mn<sub>2</sub>O<sub>7</sub>. Lower the oxidation state, more will be basic nature, e.g. MnO.
- (ii) It is due to similar atomic size, they can replace one another in metallic bond.
- (iii)  $2MnO_4 + 4KOH + O_2 ---> 2K_2MnO_4 + 2H_2O$

### Question 12:

- (a) Account for the following:
- (i) Cu+ is unstable in an aqueous solution.
- (ii) Transition metals form complex compounds
- (b) Complete the following equation:

$$Cr_2O_2$$
, + 8H+ + 3NO<sub>2</sub> - --->

#### Answer:

(a) (i) It is because hydration energy of Cu2+ overcomes 2nd ionisation enthalpy, that is why Cu+ changes to Cu2+ and Cu.

(ii) It is due to their small size, high charge and availability of vacant d-orbitals

(b) 
$$6e^{-} + 14H^{+} + Cr_{2}O_{7}^{2-} \longrightarrow 2Cr^{3+} + 7H_{2}O$$
 ...(i)  

$$[H_{2}O + NO_{2}^{-} \longrightarrow NO_{3}^{-} + 2H^{+} + 2e^{-}] \times 3$$
 ...(ii)  

$$8H^{+} + Cr_{2}O_{7}^{2-} + 3NO_{2}^{-} \longrightarrow 2Cr^{3+} + 4H_{2}O + 3NO_{3}^{-}$$
[Adding (i) and (ii)]

### Question 13:

- (a) How would you account for the following:
- (i) Highest fluoride of Mn is MnF4 whereas the highest oxide is Mn2O2
- (ii) Transition metals and their compounds show catalytic properties.
- (b) Complete the following equation:

$$3MnO_4 - + 4H + --->$$

#### **Answer:**

- (a) (i) Oxygen can form double bond, therefore, it can form Mn207, whereas 'F' cannot form double bonds, so, it can form MnF4.
- (ii) Transition metals show variable oxidation states, therefore, they and their compounds act as catalyst.
- (b)  $3MnO_4 + 4H + --- > MnO_2 + 2MnO_4 + 2H_2O$