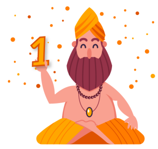

NCERT IN TEXT QUESTIONS

8.1. Silver atom has completely filled d orbitals ($4d^{10}$) in its ground state. How can you say that it is a transition element?
Ans: The outer electronic configuration of Ag (Z=47) is $4d^{10}5s^1$. It shows+1 and + 2 O.S. (in AgO and AgF_2). And in + 2 O.S., the electronic configuration is d^9 i.e, d-subshell is incompletely filled. Hence, it is a transition element.

8.2. In the series Sc (Z = 21) to Zn (Z = 30), the enthalpy of atomisation of zinc is the lowest, i.e., 126 kJ mol^{-1}. Why?
Ans: In 3d series from Sc to Zn, all elements have one or more unpaired e^{-1} s except Zn which has no unpaired electron as its outer EC is $3d^{10}4s^2$. Hence, the intermetallic bonding is weakest in zinc. Therefore, enthalpy of atomisation is lowest.

8.3. Which of the 3d series of the transition metals exhibits the largest number of oxidation states and why?
Ans: Manganese (Z = 25) shows maximum number of O.S. This is because its outer EC is $3d^54s^2$. As 3d and 4s are close in energy, it has maximum number of e^{-1} s to loose or share. Hence, it shows O.S. from +2 to +7 which is the maximum number.

8.4.

The $E^\ominus(M^{2+}/M)$ value for copper is positive (+0.34V). What is possible reason for this? (Hint: consider its high $\Delta_a H^\ominus$ and low $\Delta_{hyd} H^\ominus$)

Ans:

EC of M (Z=27) is [Ar] $3d^74s^2$

$\therefore$ EC of M^{2+} (aq) is [Ar] $3d^74s^0$

	3d					4s
i.e.,	↑↓	↑↓	↑	↑	↑	

i.e., it has 3 unpaired e^{-1}s.

$\therefore$ spin only magnetic moment $(u) = \sqrt{n(n+2)}$

B.M. $= \sqrt{3(3+2)} = \sqrt{15}$ B.M. $= 3.87$ BM

8.5. How would you account for the irregular variation of ionisation enthalpies (first and second) in the first series of the transition elements?
Ans: There is a irregularity in the IE's of 3d-series due to alternation of energies of 4s and 3d orbitals when an e^{-1} is removed. Thus, there is a reorganisation energy accompanying ionization. This results into release of exchange energy which increases as the number of e^{-1} s increases in the dn configuration. Cr has low 1st IE because loss of 1 e- gives stable EC ($3d^6$). Zn has very high IE because e~ has to be removed from 4s orbital of the stable configuration ($3d^{10}$ $4s^2$)

After the loss of one e^-, removal of 2nd e^-, becomes difficult. Hence, 2nd IE's are higher and in general, increase from left to right. However, Cr and Cu show much higher values because 2nd e^- has to be removed from stable configuration of Cr^+ ($3d^5$) and Cu^+ ($3d^{10}$)

8.6. Why is the highest oxidation state of a metal exhibited in its oxide or fluoride only?
Ans: Oxygen and fluorine have small size and high electronegativity. Hence, they can oxidise the metal to the highest O.S.

8.7. Which is a stronger reducing agent Cr^{2+} or Fe^{2+} and why?
Ans: Cr^{2+} is a stronger reducing agent than Fe^{2+}. This is because E°(Cr^{3+}/Cr^{2+}) is negative (- 0.41V) whereas E°(Fe^{3+}/Fe^{2+}) is positive (+ 0.77 V). Thus, Cr^{2+} is easily oxidised to Fe^{3+} but Fe^{2+} cannot be easily oxidised to Fe^{3+}.

8.8. Calculate the 'spin only' magnetic moment of M^{2+}(aq) ion (Z = 27).
Ans:

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

8.9. Explain why Cu^+ ion is not stable in aqueous solutions?
Ans:
Cu^+ (aq) is not stable, while Cu^{2+} (aq) is stable. This is becuase $\Delta_{hyd}H$ of Cu^{2+}(aq) is much higher than that of Cu+(aq) and hence it compensates for the 2nd IE of Cu. Thus, many Cu(I) compounds are unstable in aqueous solution and undergo disproportionation as follows :
$2\,Cu^+ \rightarrow Cu^{2+} + Cu$

8.10. Actinoid contraction is greater from element to element than lanthanoid contraction. Why?
Ans: This is due to poor shielding by 5f-electrons in the actinoids than that by 4f e^{-1}s in lanthanoids.

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