

# Atomic Energy Central School, Indore

## Class XII Chemistry CO-ORDINATION COMPOUNDS

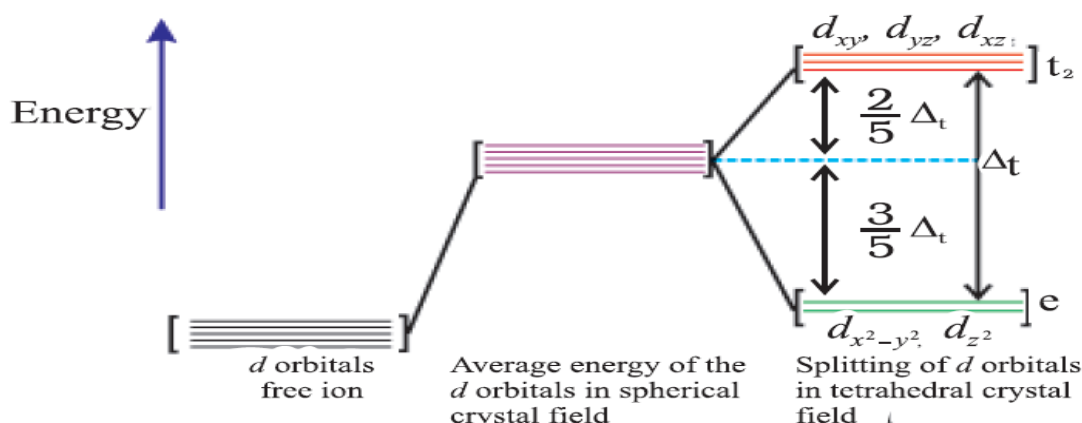
Worksheet 5/6

### Questions

1. Draw figure to show the splitting of  $d$  orbitals in a tetrahedral crystal field.
2. What is spectrochemical series?
3. Why are low spin tetrahedral complexes rarely observed?
4. Write the electronic configuration of  $d^5$  on the basis of crystal field theory when
  - i)  $\Delta_o < P$
  - ii)  $\Delta_o > P$
5. Anhydrous  $\text{CuSO}_4$  is white, but  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  is blue in colour. Explain why?

### Answers

1.



2. A series in which the ligands are arranged in a series in the order of increasing field strength is termed as **spectrochemical series**.  
 $\text{I}^- < \text{Br}^- < \text{SCN}^- < \text{Cl}^- < \text{S}^{2-} < \text{F}^- < \text{OH}^- < \text{C}_2\text{O}_4^{2-} < \text{H}_2\text{O} < \text{NCS}^- < \text{edta}^{4-} < \text{NH}_3 < \text{en} < \text{CN}^- < \text{CO}$
3. It is seen that  $\Delta_t = (4/9) \Delta_o$ . Consequently, the orbital splitting energies are not sufficiently large for forcing pairing and, therefore, low spin configurations are rarely observed.
4. (i) As  $\Delta_o < P$ , electrons will tend to excite to higher level rather than pair up, so configuration will be  $t_2g^3 e_g^2$   
 (ii) As  $\Delta_o > P$ , electrons will tend pair up rather than excite to a higher energy level, so configuration will be  $t_2g^5 e_g^0$ .
5. In the absence of ligand, crystal field splitting does not occur,  $d-d$  transmission of electrons is not possible and hence anhydrous  $\text{CuSO}_4$  is colourless. In  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , four  $\text{H}_2\text{O}$  molecules act as ligands and cause crystal field splitting and so it appears coloured blue.