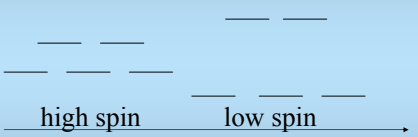
High-spin or low-spin ?

Octahedral d^4 – d^7



Spin pairing energy >< Δ

Δ

Spin pairing energies – Δ-values

- Pairing energies M^{z+}_{gas} : ~20% smaller in ML_n^{z+}

Energy $10^3 cm^{-1}$	Ti	V	Cr	Mn	Fe	Co	Ni	Cu
Δ from Maq_6^{2+}		12.2	13.9	7.7	10.4	9.7	8.5	12.5
Δ from Maq_6^{3+}	20.4	19	14.7	21	14	20		
P M^{2+}			23.5	25.5	17.6	22.5	27	
P M^{3+}				28	30	21		

Following slides

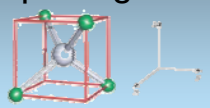
- Fig 21.6 (iron case)
- Then 31, 34 in this series
- Fig 21.8 (tetrahedral splitting)
- Fig 21.10 (tetragonal distortion)
- Fig 21.11(other geometries)
- Then 38 in this series
- Fig 21.25 (how to measure magnetism)

Low spin complexes:

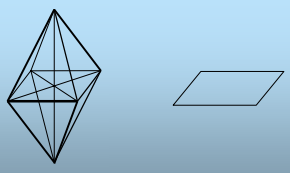
- Strong field ligands
- Many d^6-systems in 1st row
  - All known Co(III)-complexes except CoF_6^{3-}
  - Several Fe(II)- complexes
- More frequent (in 2nd row) to dominating (in 3rd row)

Other frequent geometries

- Tetrahedral



- Tetragonal (elongated or square planar)



Magnetic behaviour

- An unpaired electron has a magnetic moment, which makes a species (molecule, ion…) paramagnetic by being attracted into a magnetic field.

  $\mu = 2\sqrt{(S+1)}S$; $(S=\Sigma s)$ (spin-only)

- Measured as the magnetic susceptibility χ at a given temperature $\mu = k \cdot \sqrt{\chi \cdot T}$