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## Crystal Field Splitting

### Definition

- **Crystal Field Splitting** is the phenomenon
- of *splitting* of  $d$ - orbital into **energy levels**
- The **energy levels** are  $e_g, t_{2g}$  followed by the **arrangement** of **electrons** in these **orbitals**
- based on their **pairing energy** and **crystal field splitting energy**

### Mechanism of crystal field splitting

- **A central metal** atom is **surrounded** by *ligands* from all sides.
- The *electrons* of **ligands** and **metal** atom interact.
- **The**  $d$ - orbital of **metal** atom breaks into two energy levels.
  - $e_g$
  - $t_{2g}$
  - $e_g$  has two **orbitals**
  - $t_{2g}$  has **three orbitals**.
  - $e_g$  has **higher** energy level.
  - $t_{2g}$  has **lower** energy level.
- **Electrons** fill up at the **lower** energy level.
- The remaining **electron** have two choices:
  - **pair** up with  $t_{2g}$
  - **move** to  $e_g$
- **Electrons** move to  $e_g$  if,
  - **Pairing Energy** > **Crystal Field Splitting Energy**
  - This case has **high spin complex**.
- **Electrons** pair at  $t_{2g}$  if,
  - **Crystal Field Splitting Energy** > **Pairing Energy**
  - This case has **low spin complex**

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## Strength of Ligands

- **Weak field ligands** have **less** gap between  $e_g$  and  $t_{2g}$ .
- **Strong field ligands** have **more** gap between  $e_g$  and  $t_{2g}$ .