Stoichiometric - Crystal defect :

Imperfection defect : Any deviation of ideally perfect crystal from the periodic arrangements from the periodic arrangements of its constituents.

Point Defect :

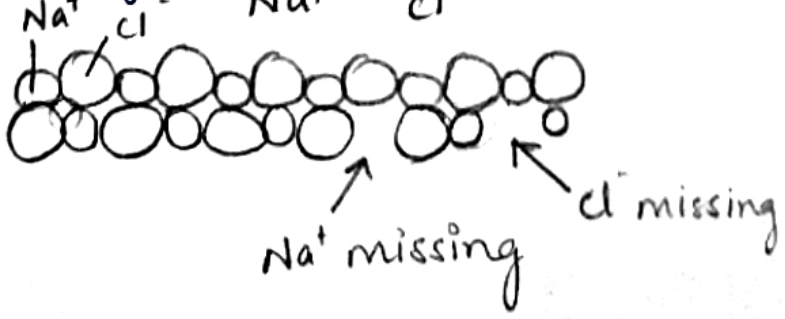
Occurs due to → missing atoms / displaced atoms / Extra atoms
→ imperfect packing during crystalization
→ Thermal vibrations of atoms at high temperature.

Common (point) deffects → Schottky
→ Frenkel

Schottky :

It arrises when some lattice points are unoccupied.
It is called lattice vaccancies.

Existence of two vaccancies :



As a whole;

→ The charge of the crystal ~~is~~ will remain neutral, as the number of missing Na^+ and Cl^- is same.

→ Generally occurs in ionic crystal in which (+)ve and (-)ve ions do not differ much in size.

examples: NaCl, CsCl.

→ It conducts electricity (a small extent) by an ionic mechanism.

Under Electric field;

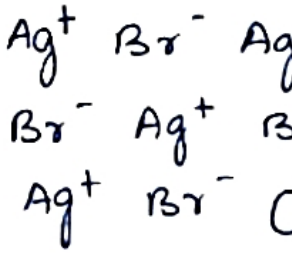
→ nearby ion moves to a vacancy and creates ~~at~~ a new vacancy and another nearby ion move into it and so on.

→ This process continues resulting in the migration of the vacancy and interm ~~of~~ the ion from one end to other end of the crystal.

→ This accounts for the phenomenon of diffusion in solids.

Frankel:

These defects arrise when an ion occupies an interstitial position between the lattice points.



As seen, the Ag^+ occupies a position in the interstitial space rather than its own appropriate site in the crystal lattice.

A ~~vacca~~ vacancy is created and crystal remains neutral.

The presence of Ag^+ in interstitial site is responsible for the formation of photographic image on exposing to light. (photographic plate)

Another example : $ZnS \Longrightarrow Zn^{2+}$ entrapped in interstitial.

The detects appear in crystal in which the (-)ve ions are much larger than the (+)ve ions.

It is responsible for the conduction of electricity and for the phenomenon of diffusion in solids.

Non-stoichiometric Defect :

→ Less common defect.

Metal excess

NaCl - Heated in Na - vapor

↓

acquires yellow ~~colour~~ colour

→ It is due to non-stoichiometric compound of NaCl in which there is a slight excess of Na^+.

Na → metal gets doped → in NaCl crystal

Na → ionises as $Na^+ + e^-$.
due to crystal energy.
↓
(crystal stability - more energy less stable)

→ Herein the e^- occupies a site that would otherwise be filled by Cl^- ion.
→ There are 6 Na^+ ions adjacent to the central e^-.

→ The extra e^- is thus shared between the six Na^+ ions which implies that e^- delocalises.

→ Light energy absorbed, when this e^- makes easy transition from ground state to an excited state.

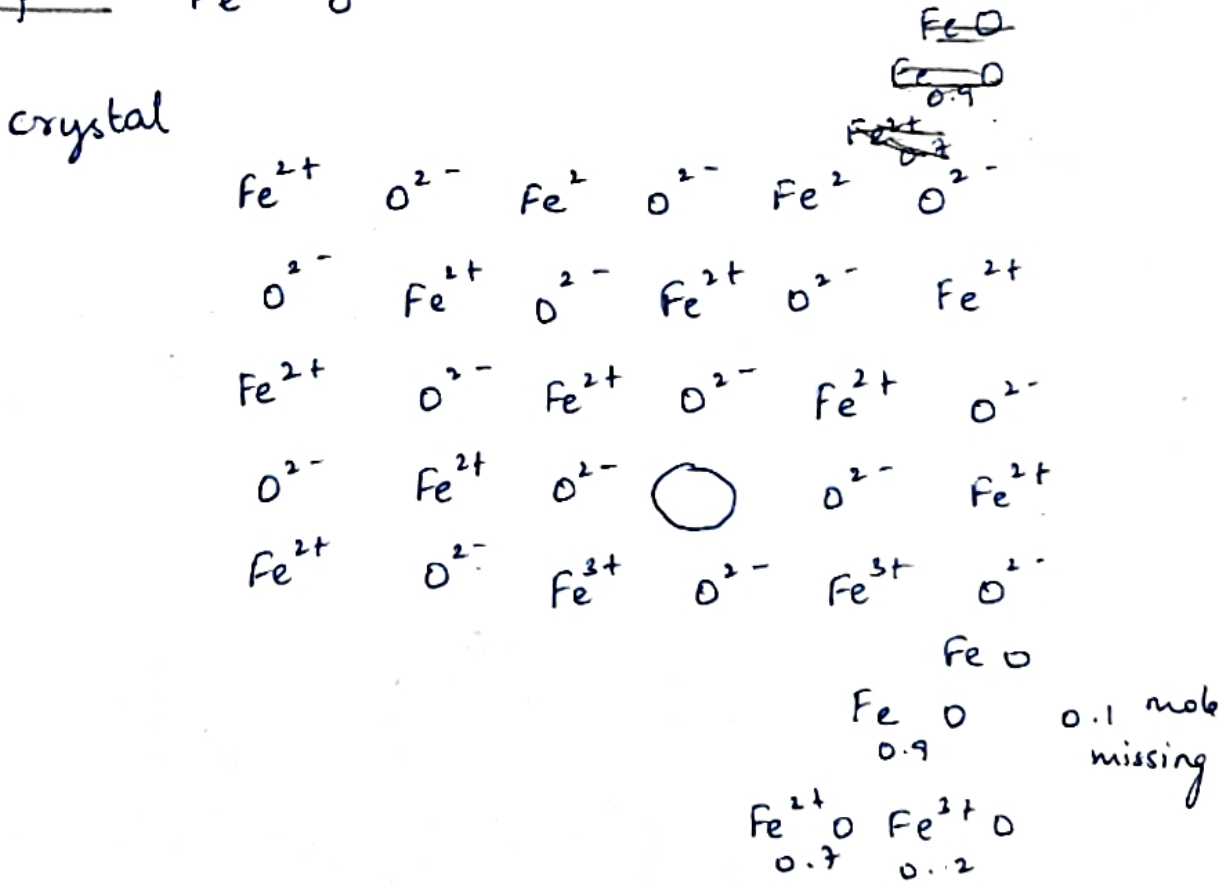
→ Thus, non-stoichiometric form of NaCl appears coloured.
→ The sites, occupied by the extra e^- are known as colour centres, also called as F. centres.
→ Non stonichoiometric NaCl is represented as $Na(1+\delta)Cl$, where δ is excess sodium metal doped.

parallely, the KCl crystal gets doped with extra K atom, by exposing the KCl to K metal vapor. The non-stoichiometric crystal exhibit magenta colour.

Metal Deficiency:

In certain cases, one of the positive ions is missing from its ~~the~~ lattice site and the extra (-)ve charge is balanced by some nearby metal ion by acquiring higher (addition) charges.

Example: Fe^{2+} O^{2-}



Creation of vaccancies / Holes lowers the density as well as crystal ~~crysto~~ lattice energy (Energy releases during crystallization) (or) stability of the crystal.

more energy released → more stability.

Less energy release → Less stability.