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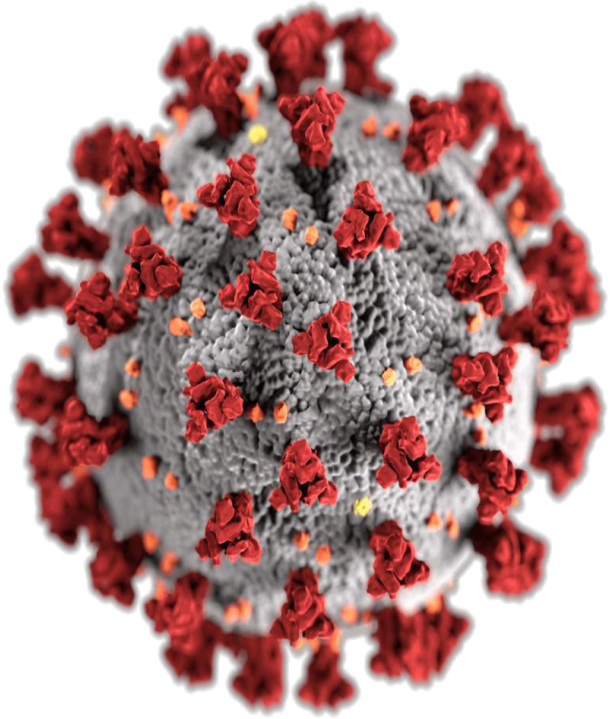
Welcome to my Class

Physics Ph 1101

11:45 AM
October 21, 2020

COVID-19 Precautions



- Don’t be afraid
- Be aware of the pandemic
- Use appropriate outfits if you compelled to go out
- Try to maintain proper diet
- Do not forget to exercise (at least one hour) regularly
- Try to follow the guidelines of WHO and Bangladesh Government
- Try to stay at home

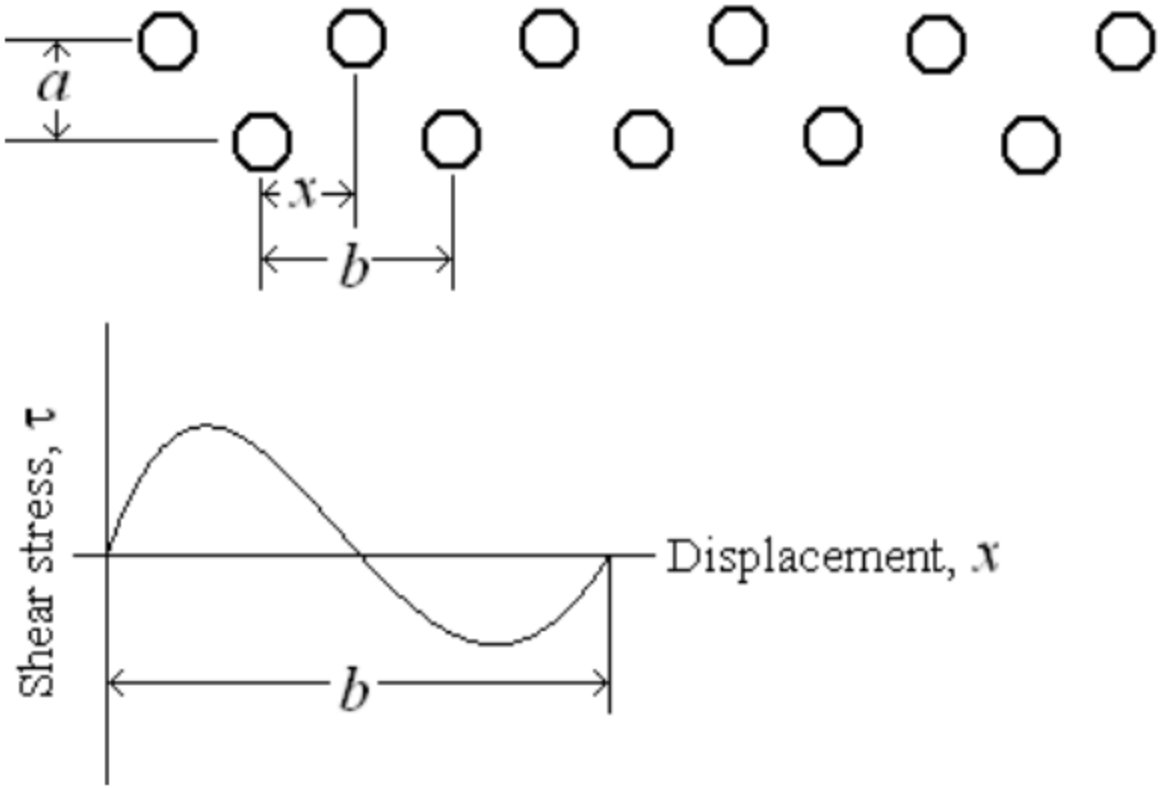
Imperfections in Crystalline Solids

a) Theoretical yield strength, Point defects and Line defects or Dislocations

b) Interfacial defects, Bulk or Volume defects and Atomic vibrations

Theoretical yield strength

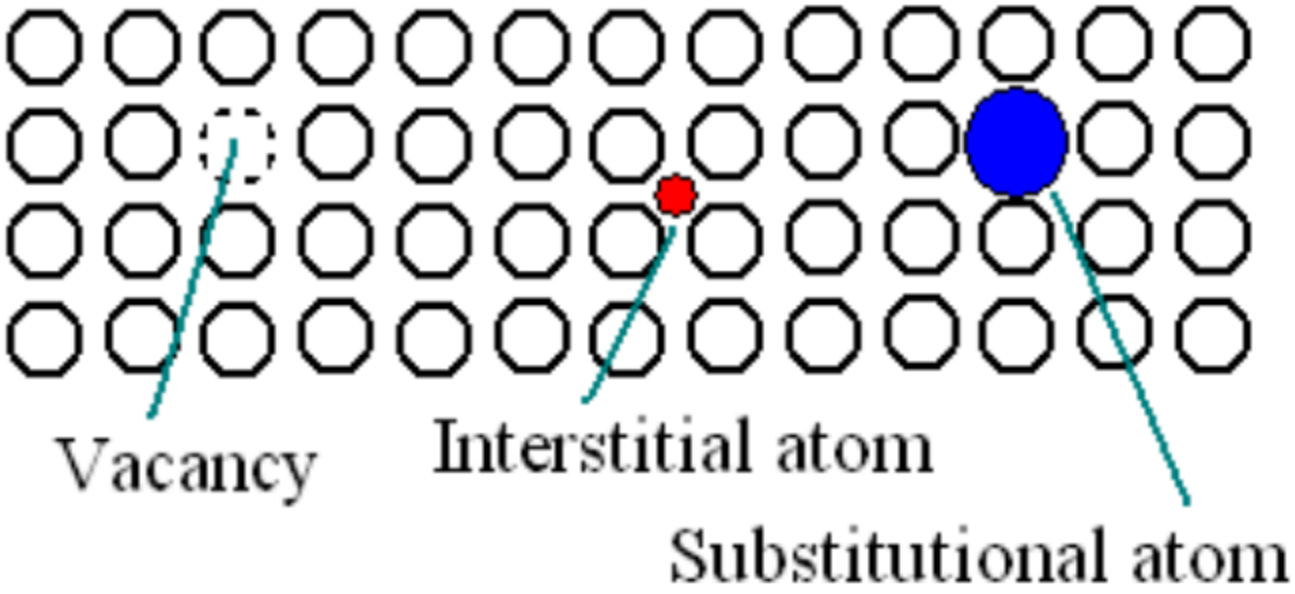
Ideal solids are made of atoms arranged in orderly way.


a
x
b
Shear stress, τ
Displacement, x
b

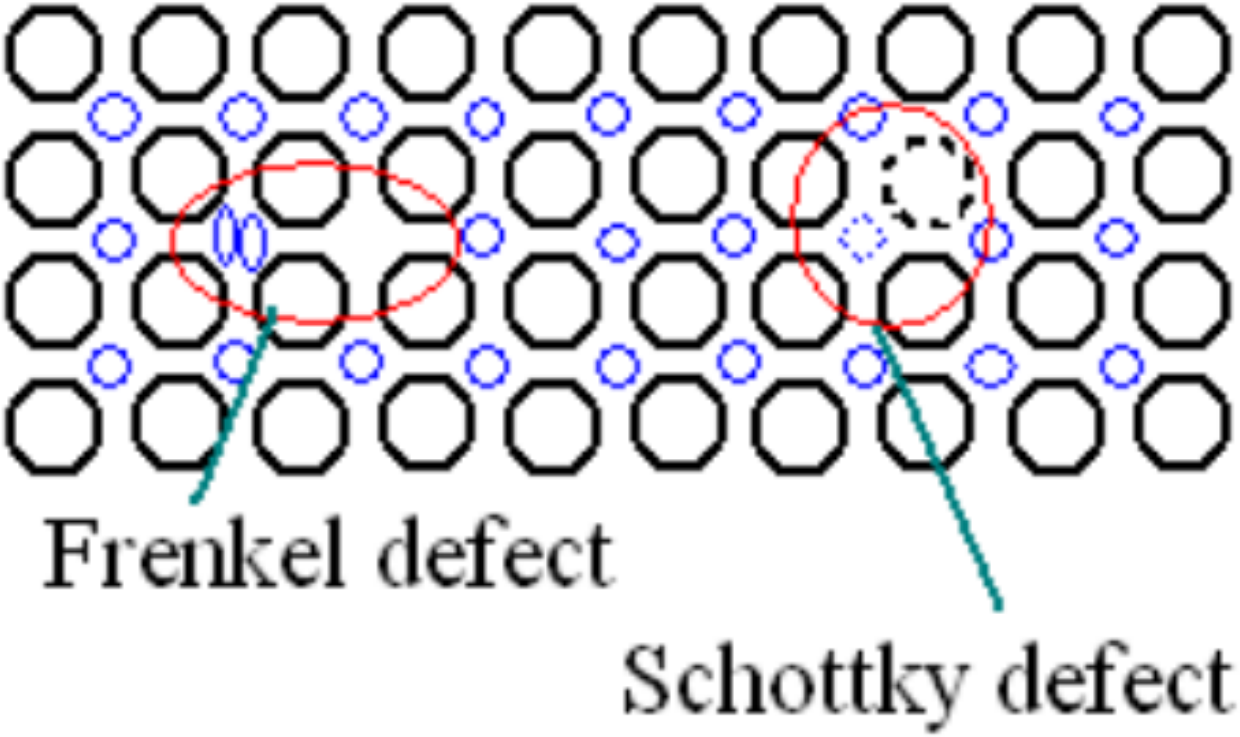
Point defects

Point defects are of zero-dimensional i.e. atomic disorder is restricted to point-like regions.

Thermodynamically stable compared with other kind of defects.



In ionic crystals, defects can form on the condition of charge neutrality. Two possibilities are:



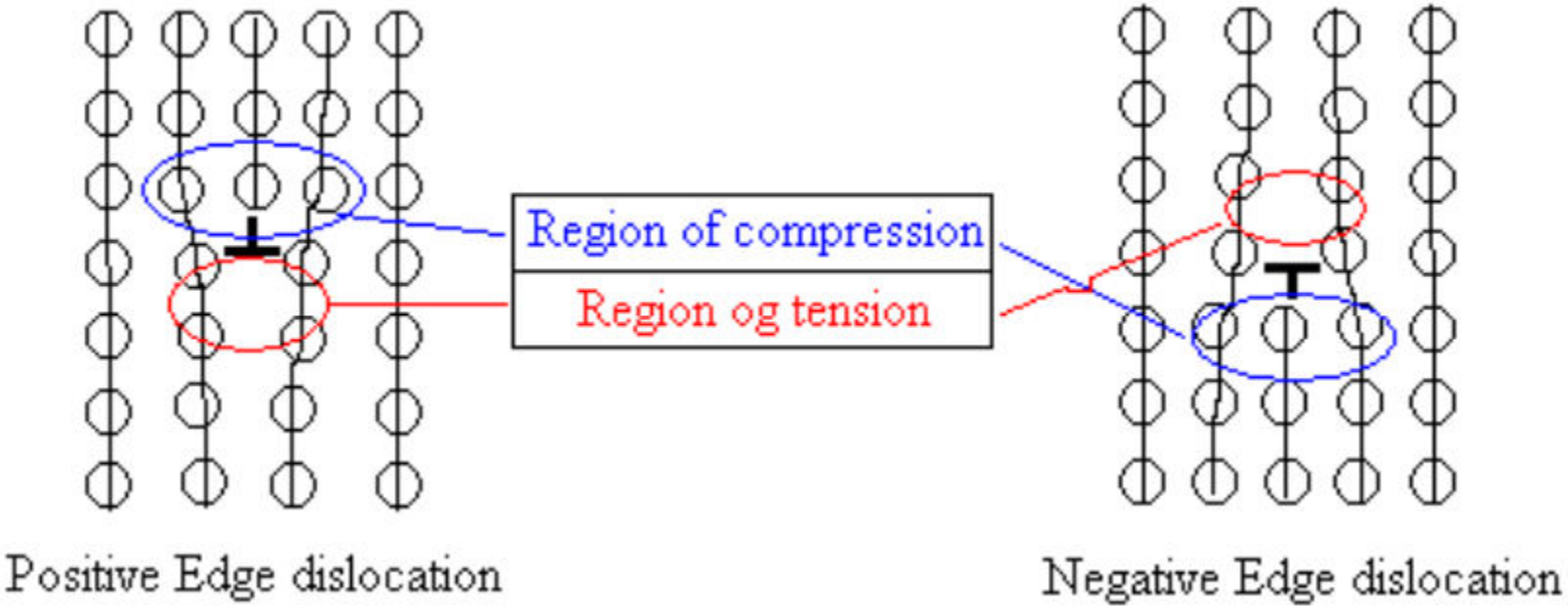
Line defects

Line defects or Dislocations are abrupt change in atomic order along a line.

They occur if an incomplete plane inserted between perfect planes of atoms or when vacancies are aligned in a line.

A dislocation is the defect responsible for the phenomenon of slip, by which most metals deform plastically.

Dislocation form during plastic deformation, solidification or due to thermal stresses arising from rapid cooling.

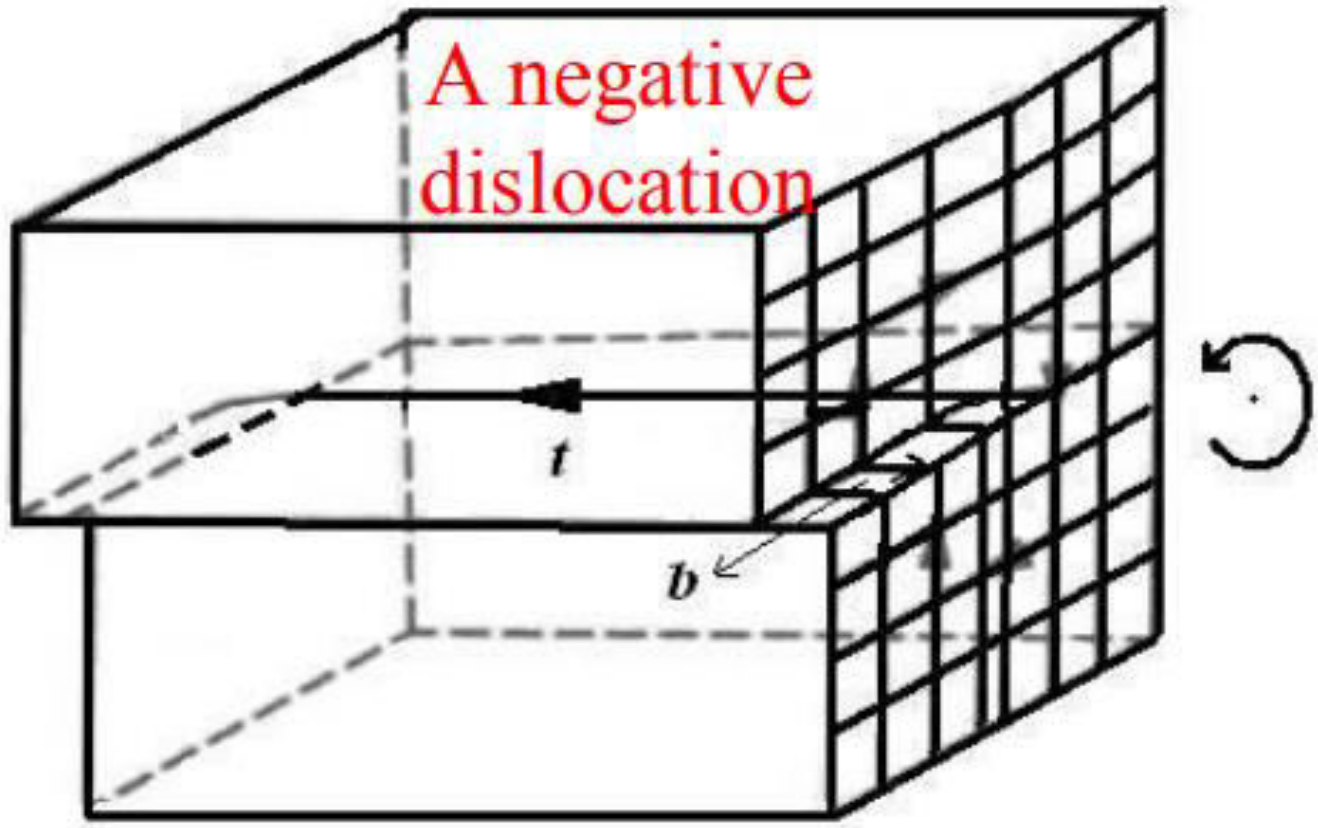


Line defects – Screw dislocation

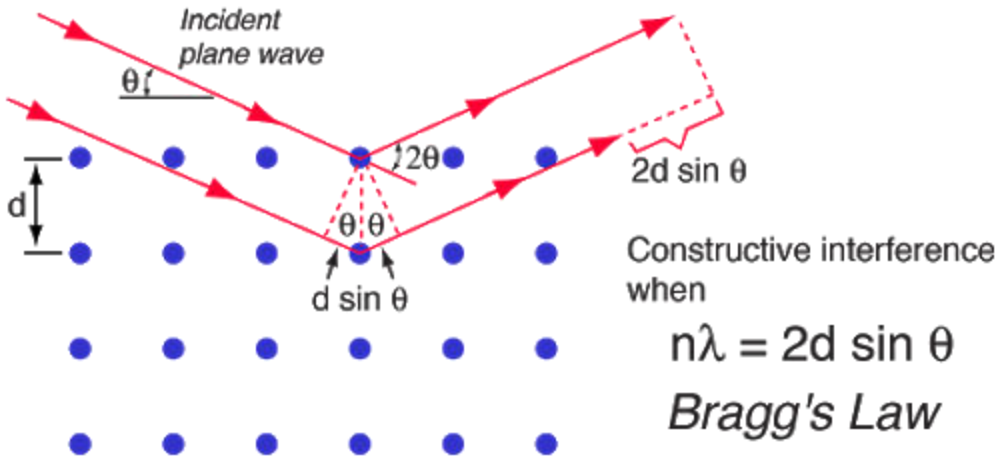
It is also called as Burger's dislocation

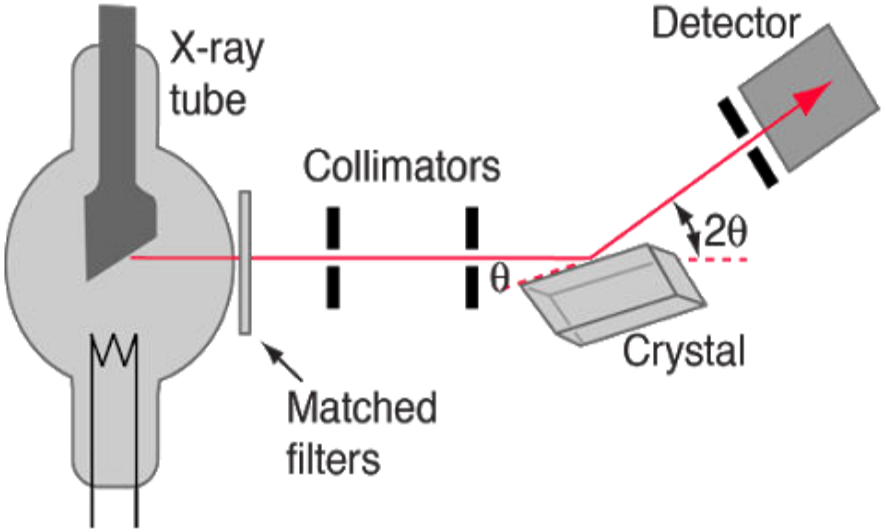
It will have regions of shear stress around the dislocation line

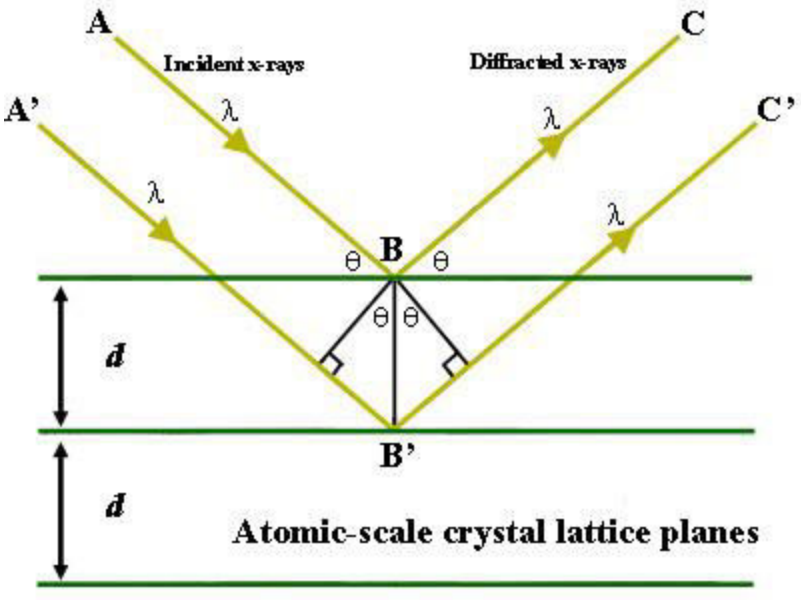
For positive screw dislocation, dislocation line direction is parallel to Burger's vector, and vice versa.



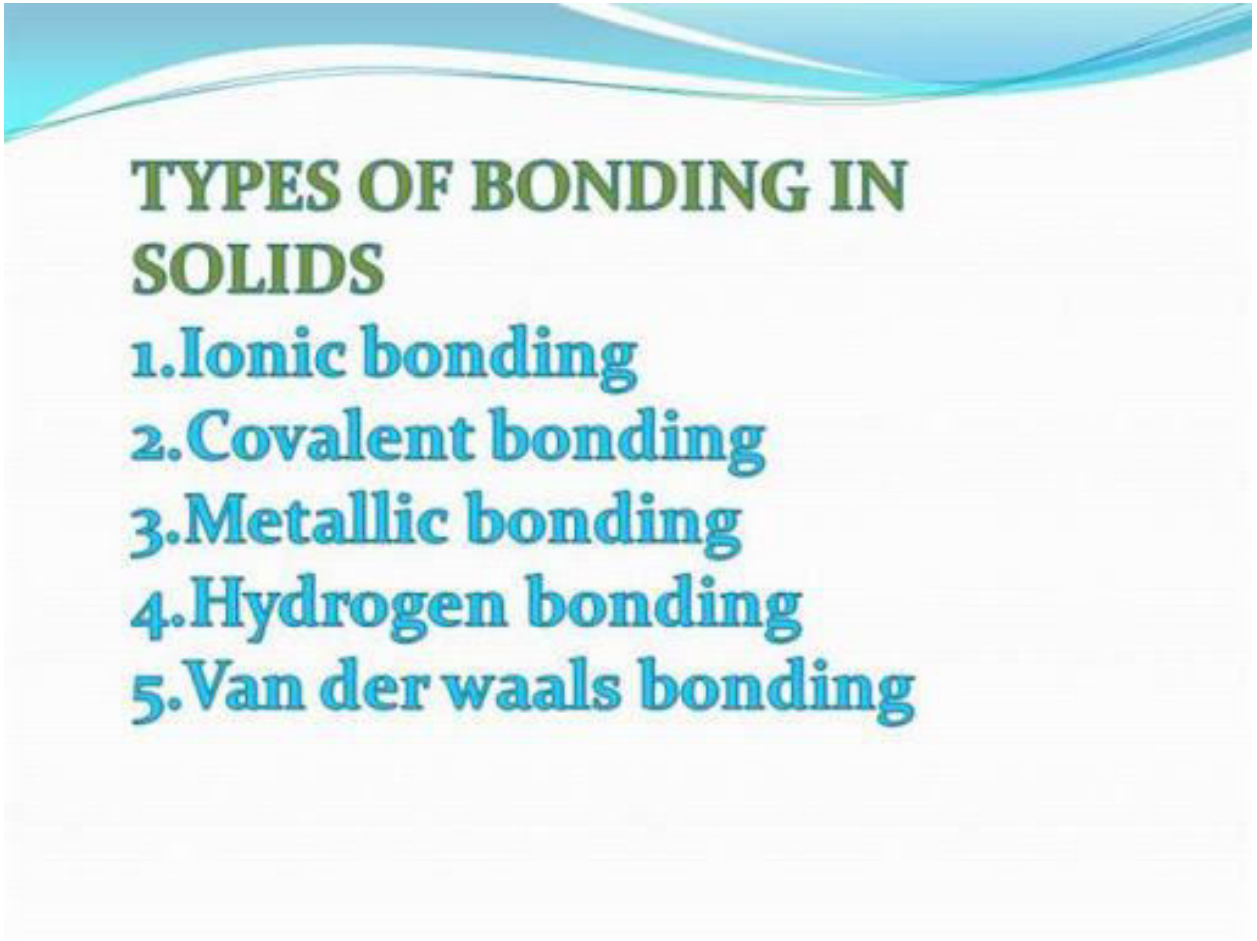
x-ray diffraction and Bragg's law







Solid state of Matter



Bonding in Solids

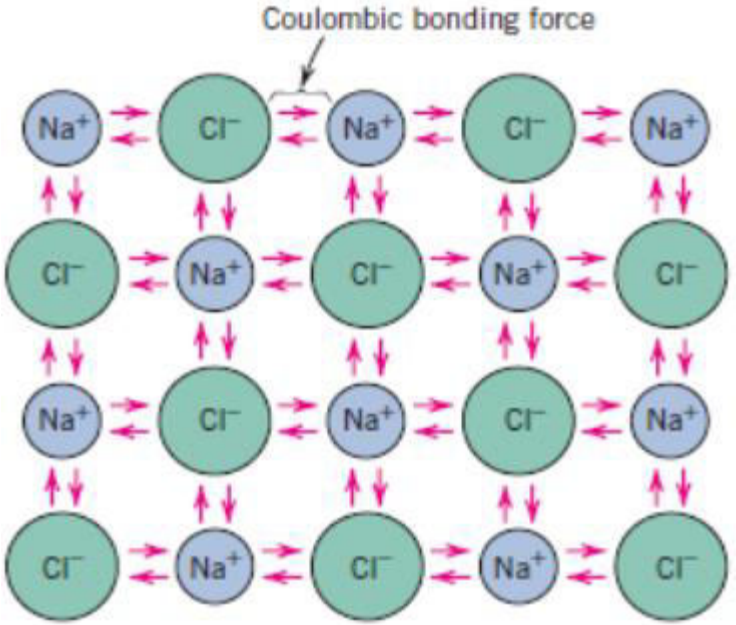
- There are four types of solid:

1. **Molecular** (formed from molecules) - usually soft with low melting points and poor conductivity.
2. **Covalent network** - very hard with very high melting points and poor conductivity.
3. **Ionic** (formed form ions) - hard, brittle, high melting points and poor conductivity.
4. **Metallic** (formed from metal atoms) - soft or hard, high melting points, good conductivity, malleable and ductile.

– NB: A solid with only one type of atom is also called '**atomic**'

PROPERTIES OF IONIC SOLIDS

- Ionic solids are rigid, unidirectional and crystalline in nature.
- They have high melting and boiling points.
- Ionic solids are good insulators of electricity in their solid state and good conductor of electricity in their molten state.
- Ionic solids are soluble in water and slightly soluble in organic solvents.



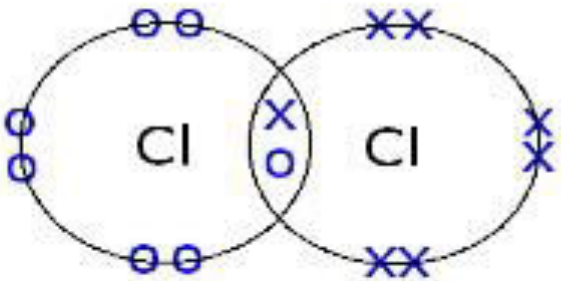
COVALENT BONDING

A covalent bond is formed, when two or more electrons of an atom, in its outermost energy level, are shared by other atoms. e.g.-Chlorine molecule.

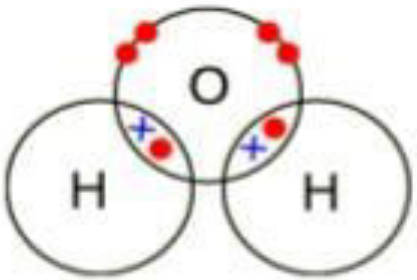
In this bonding a stable arrangement is achieved by sharing of electrons rather than transfer of electrons.

Sometimes a covalent bond is also formed when two atoms of different non-metals share one or more pair of electrons in their outermost energy level.

e.g.- Water molecule



Bonding between two atoms of same element



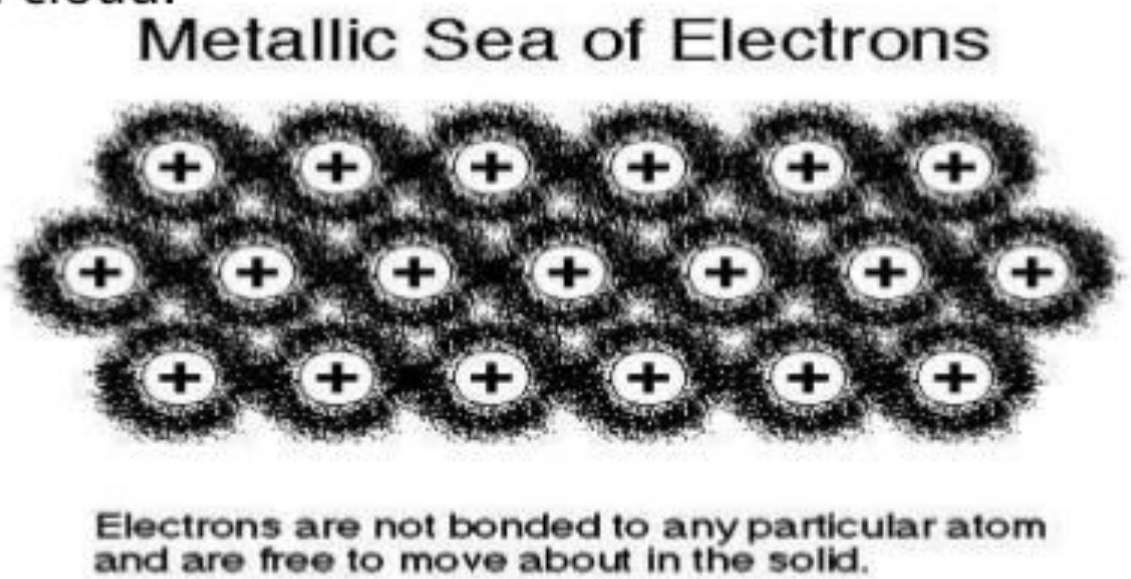
Bonding between two different non-metals

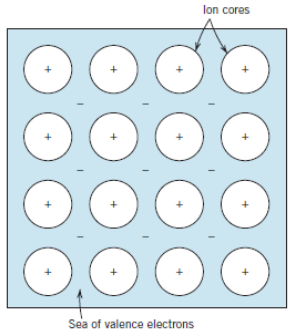
METALLIC BONDING

It has been observed that in a metal atoms, the electrons in their outermost energy levels are loosely held by their nucleii.

Thus a metal may be considered as a cluster of positive ions surrounded by a large number of free electrons, forming electron cloud.

e.g.- a

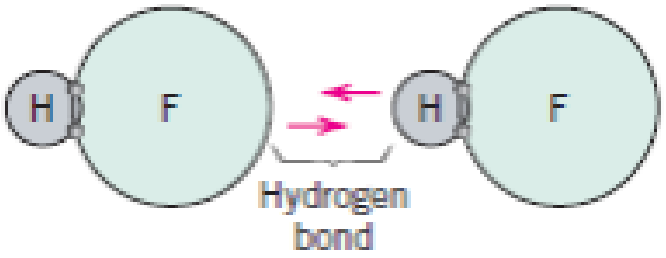




PROPERTIES OF HYDROGEN BONDED SOLIDS

- The hydrogen bonds are directional
- Relatively strong bonding
- These solids have low melting point
- No valence electrons hence good insulators
- Soluble in both polar and non-polar solvents
- They are transparent to light

e.g. – water molecule, ammonic molecules

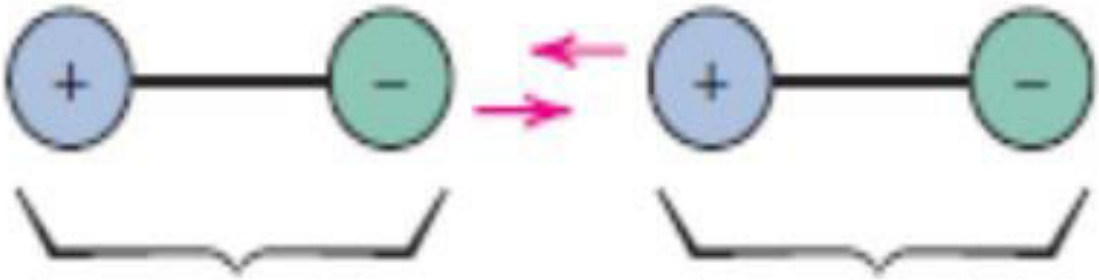


VAN DER WALLS BONDING

Weak and temporary bonds between molecules of the same substance are known as Van der Walls bonding.

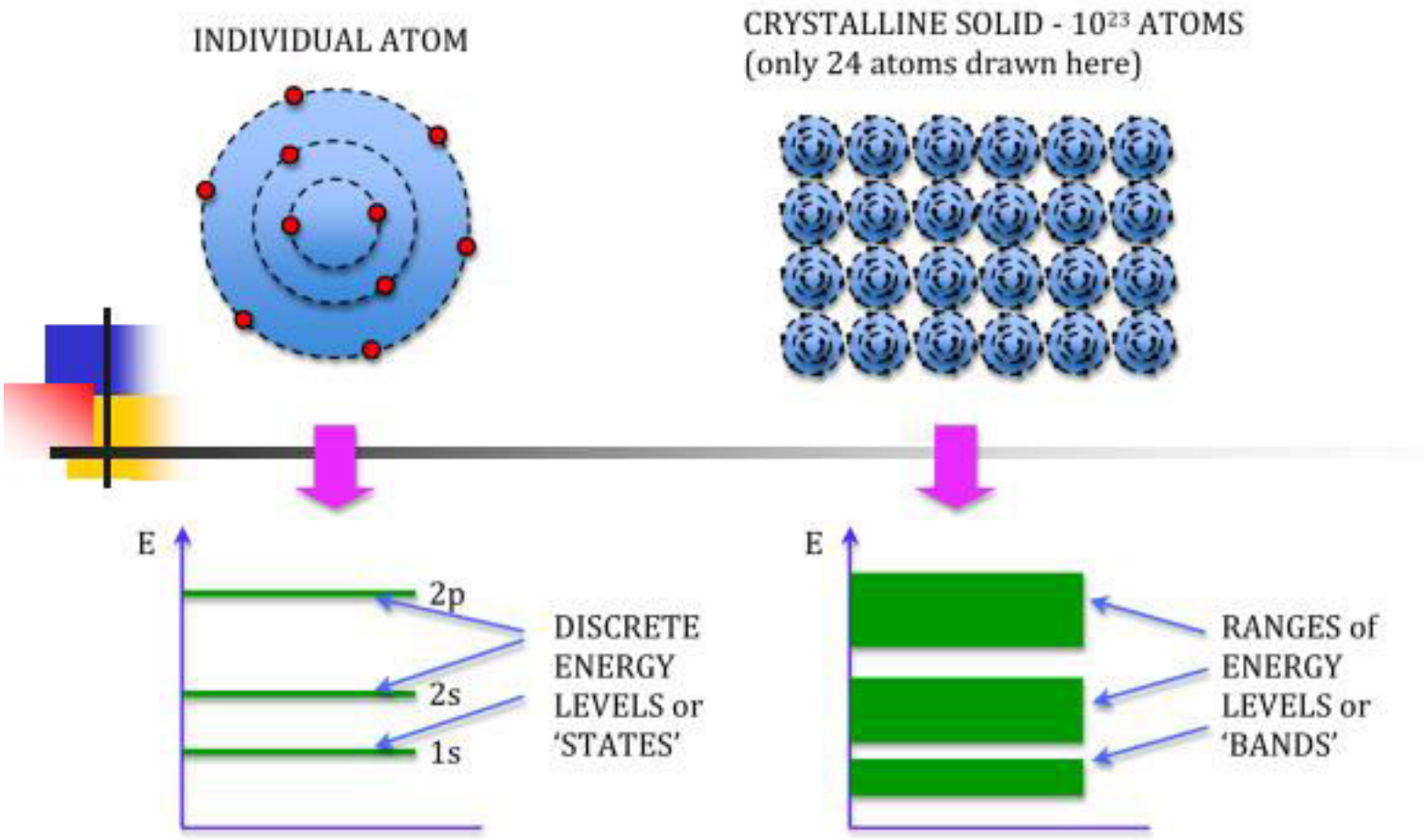
Types of Van der walls forces

1) dipole-dipole
2) dipole-induced dipole
3) dispersion

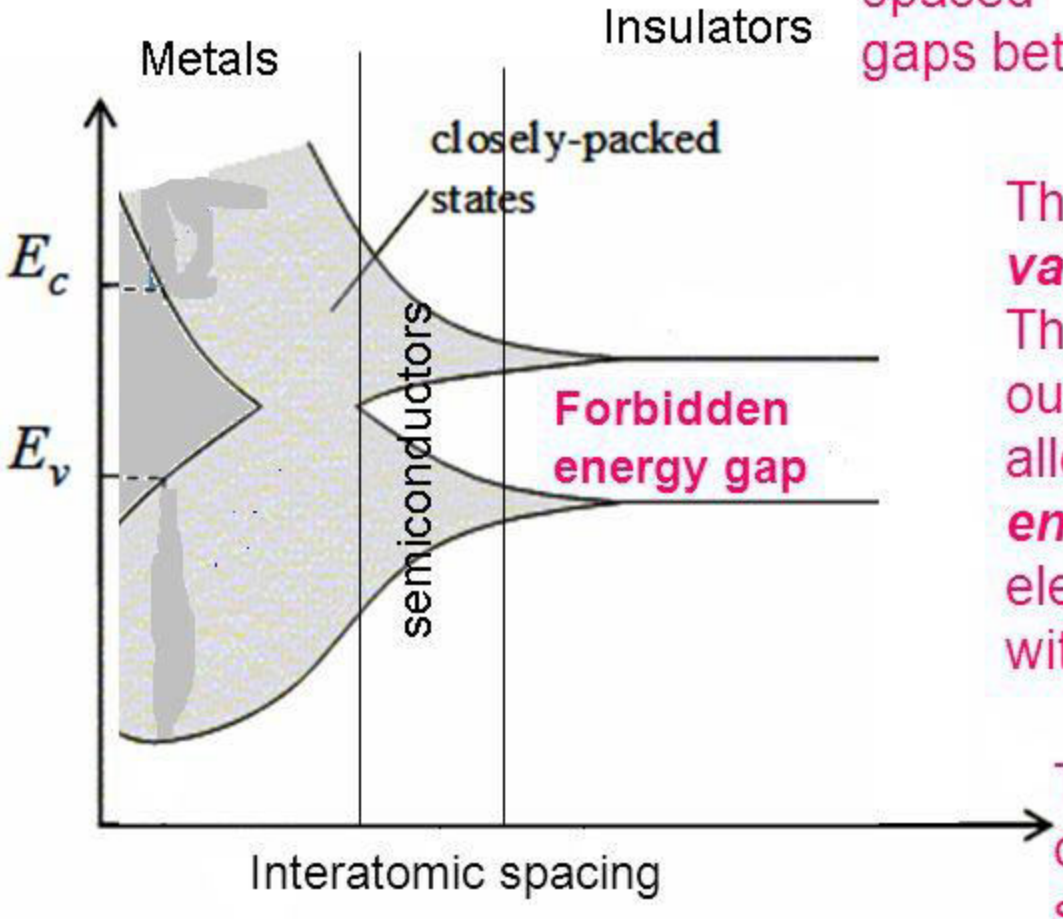


Atomic or molecular dipoles

Classification of Solids

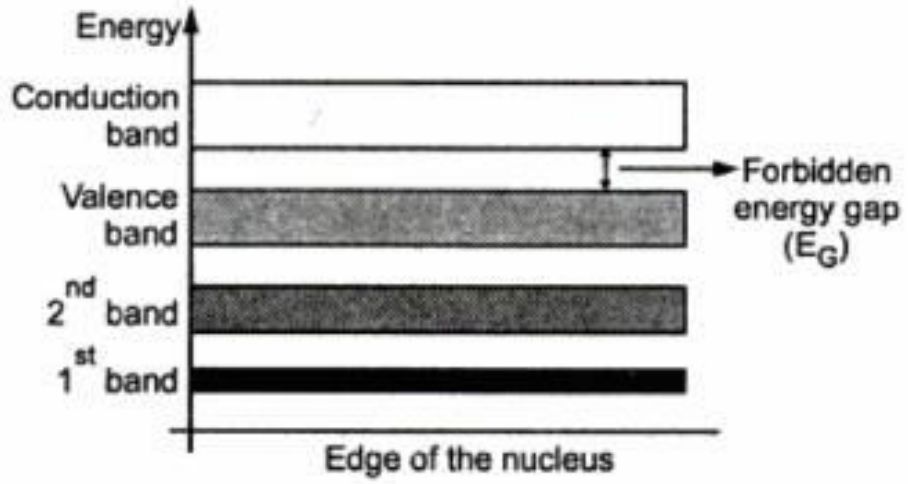


In a solid many atoms are brought together so that the split energy levels form a set of bands of very closely spaced levels with forbidden energy gaps between them as shown in Fig.

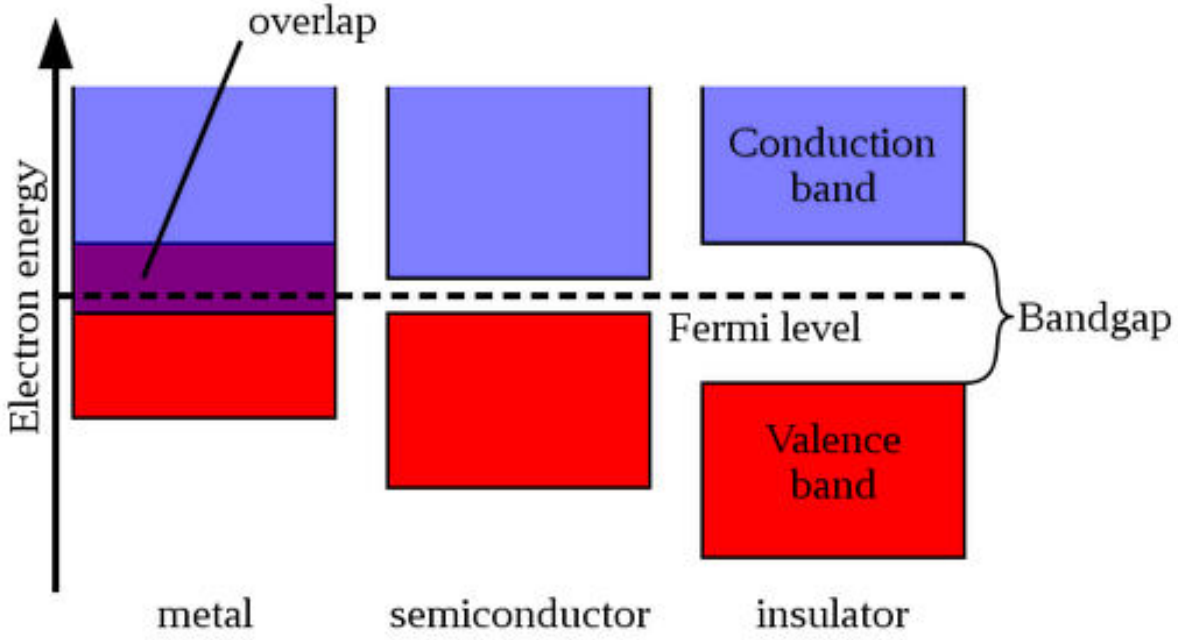


There are two energy bands called ***valence*** and ***conduction bands***. The band corresponding to the outer most gaps between these two allowed bands is called ***forbidden energy gap*** or ***band gap*** since electrons can't have energy values with in the forbidden energy gap.

The valence electrons are occupied in the valence band, since they are responsible for electrical, thermal and optical properties of solids.



Energy band diagram




I Thank you