VC210 Recitation Class 4

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Contents

Intermolucular Force

	Between
Ion-Dipole	Ions & polar molecules
Dipole-Dipole	Polar molecules
London Force	All molecules

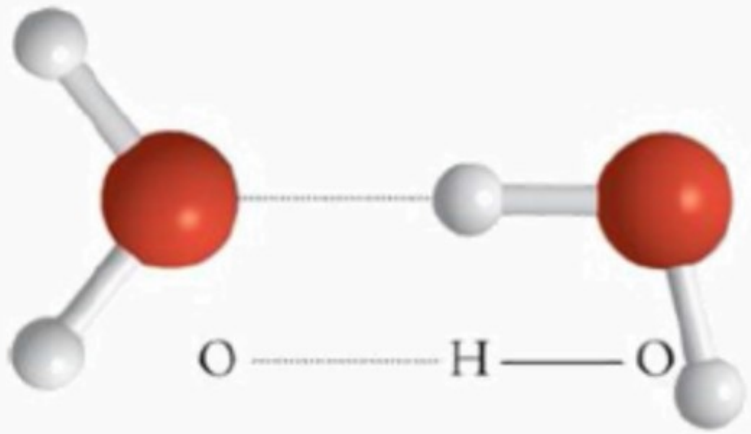
- Hydration: H_2O & solute ions.
- Cations with (1) samller radius (2) higher charge have stronger ion-dipole interactions.
- London force: rod-like molecules > spherical shaped moledules

Hydrogen bonding

Hydrogen Bonds

X-H···X

X = N, O, F



- X: highly electronegative atom with a lone pair electrons.
- Hydrogen bonding can exist in vapour phase.

Liquids

- Viscosity: reflects the intermolecular interaction.
  - The higher the viscosity, the more sluggish the flow.
  - Chain-like molecules have higher viscosity.
- Surface Tension: decreases with rising temperatures
- Adhesion: interaction between liquids and surfaces of solid substances.
  - Water spreads out over the glass.
- Cohesion: a bulk force binding a material.
  - Water stays as liquid or form a drop.
- Meniscus:
  - Upward: Adhesion $\approx$ Cohesion
  - Downward: Cohesion $>$ Adhesion

Physical properties for comparing Intermolucular force

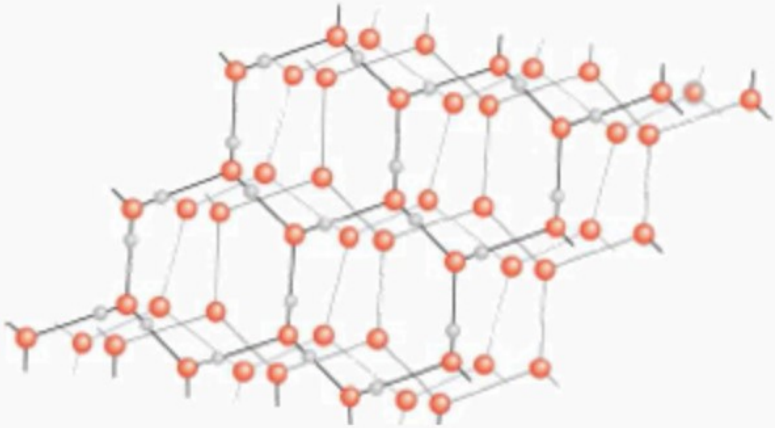
Summary: how to compare the strength of intermolecular interactions?

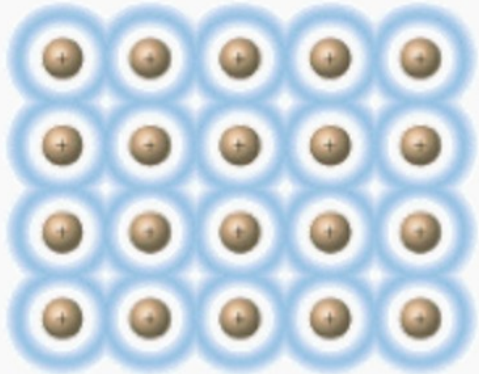
1. Boiling point
2. Surface tension
3. Viscosity
4. Vapor pressure (inverse proportion)
5. Surface area

*Vapor Pressure is the pressure of the vapor phase in equilibrium with a liquid.

Different types of solid

- Molecular Solids: discrete molecules with strong intermolecular forces.
- Network Solids: atoms covalently bonded.
- Metallic Solids: cations held together by electron sea.
- Ionic Solids: mutual attractions of cations and anions.

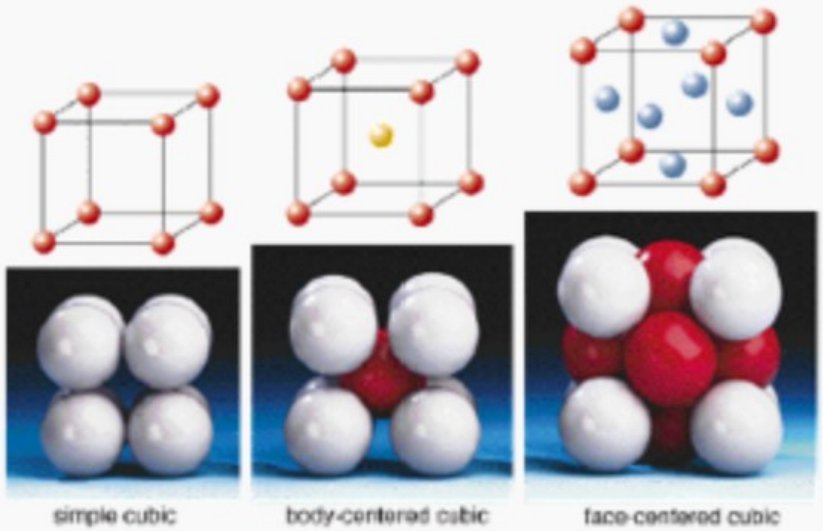




Cell

- Unit cell: the smallest region the crystal lattice.
- How to count atom number in a unit cell:
  - Corner atom: $\frac{1}{8}$
  - Face atom: $\frac{1}{2}$
  - Body atom: 1

Three kinds of unit cells you need to understand



Cubic Unit Cell	Coordinaiton numbre	occupation ratio
face centered (fcc)	12	74%
body centered (bcc)	8	68%
primitive cubic (pcc)	6	52%

Exercise

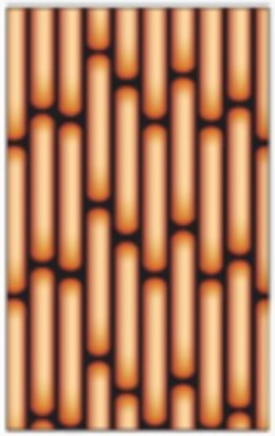
Calculate occupation ratios of the three kinds of unit cells.

Using radius ratio to decide on unit cell

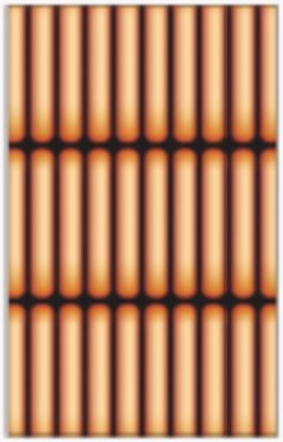
$$Radius\ ratio = \frac{Radius\ of\ the\ smaller\ ion}{Radius\ of\ the\ larger\ ion}$$

- radius ratio < 0.414: fcc
- $0.414 <$ raius ratio < 0.732: bcc
- radius ratio > 0.732: pcc

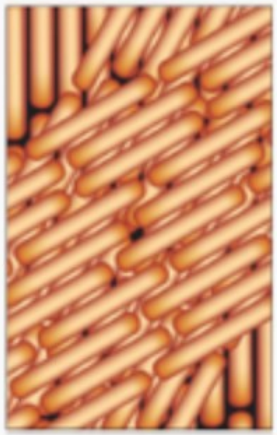
Liquid Crystal



Nematic phase, parallel molecules, and staggered along their long axes.



Smectic phase, molecules are parallel and they line up next to form sheets.



Cholesteric phase, sheets of parallel molecules are rotated relative to their neighbors and form a helical structure.

You should get familiar with:

- Name of states.
- Orientation and more generally, shape, of each state.

End

Extension materials is posted on canvas (in the same file of this slides)
Remarks on Quiz 1 T_{14}.
Forget the grade of quiz 1 and move on to next stage!