

Thapar Institute of Engineering & Technology (Deemed to be University)

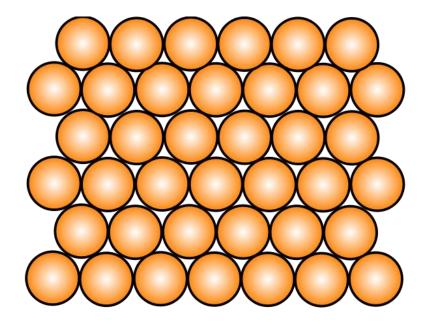
Bhadson Road, Patiala, Punjab, Pin-147004

Contact No.: +91-175-2393201 Email: info@thapar.edu

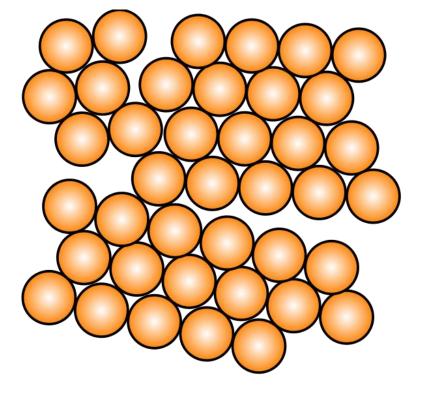


Types of materials

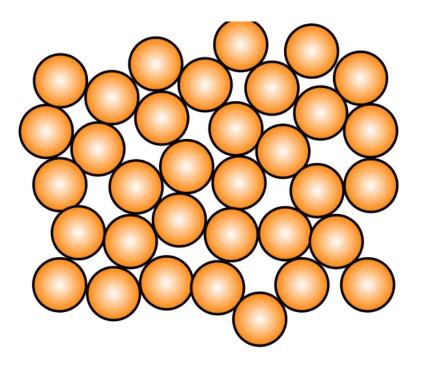
Monocrystalline



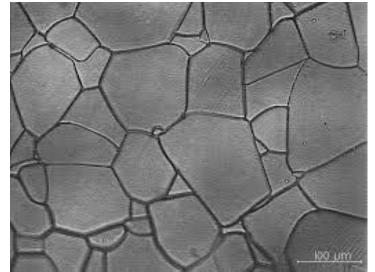
Polycrystalline



Amorphous





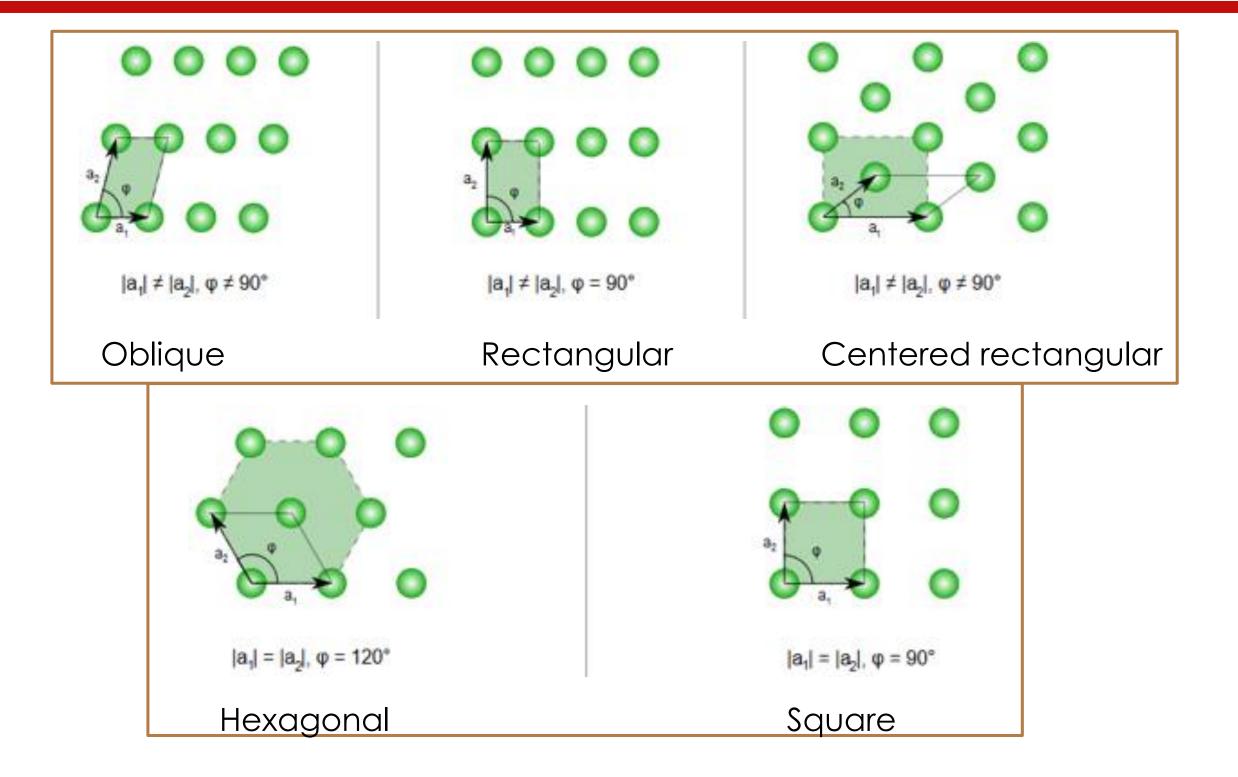




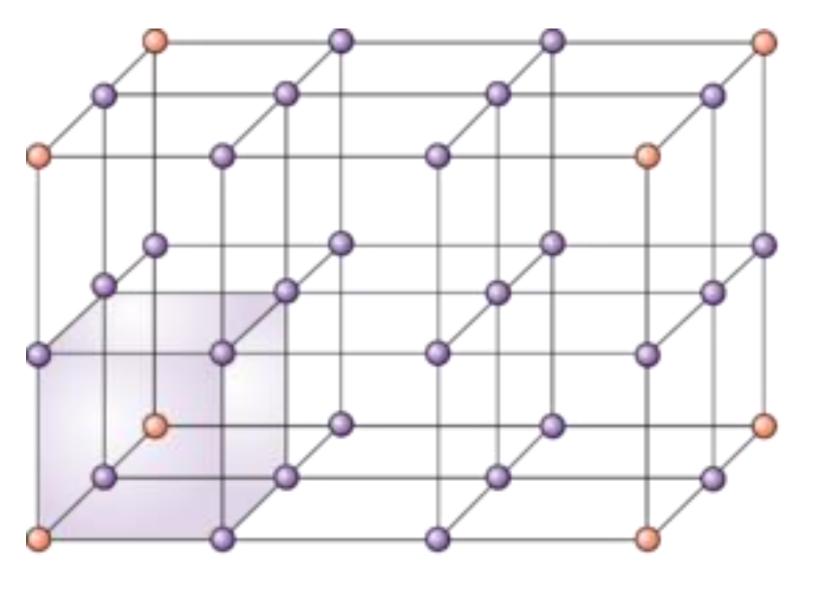


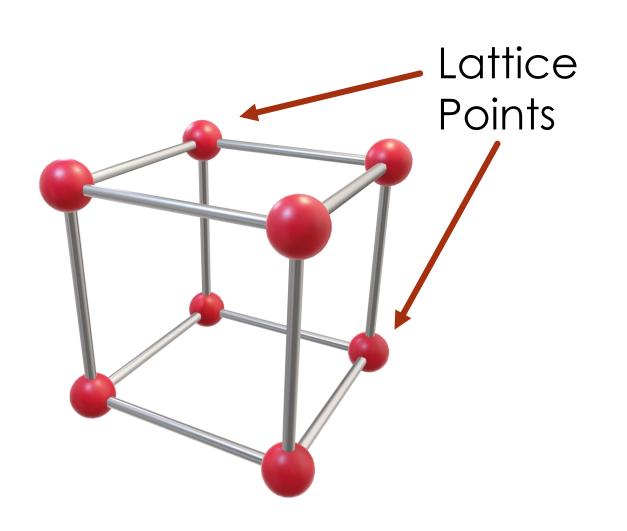
- Crystalline structures can be understood by considering atoms as a hard spheres.
- These hard spheres can be situated at Imaginary point in a space used to describe position of atom/ion/molecule.
- These imaginary points are called as Lattice Points.
- The smallest repeating unit of lattices is called as Unit Cell.
- A lattice is formed by repeating unit cells.
- 1-D lattice Linear lattice
- 2-D lattice Space lattice
- 3-D lattice Crystal lattice







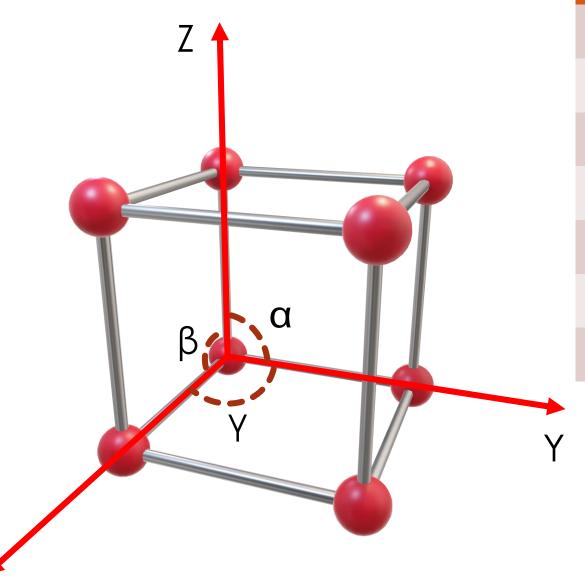




Unit cell

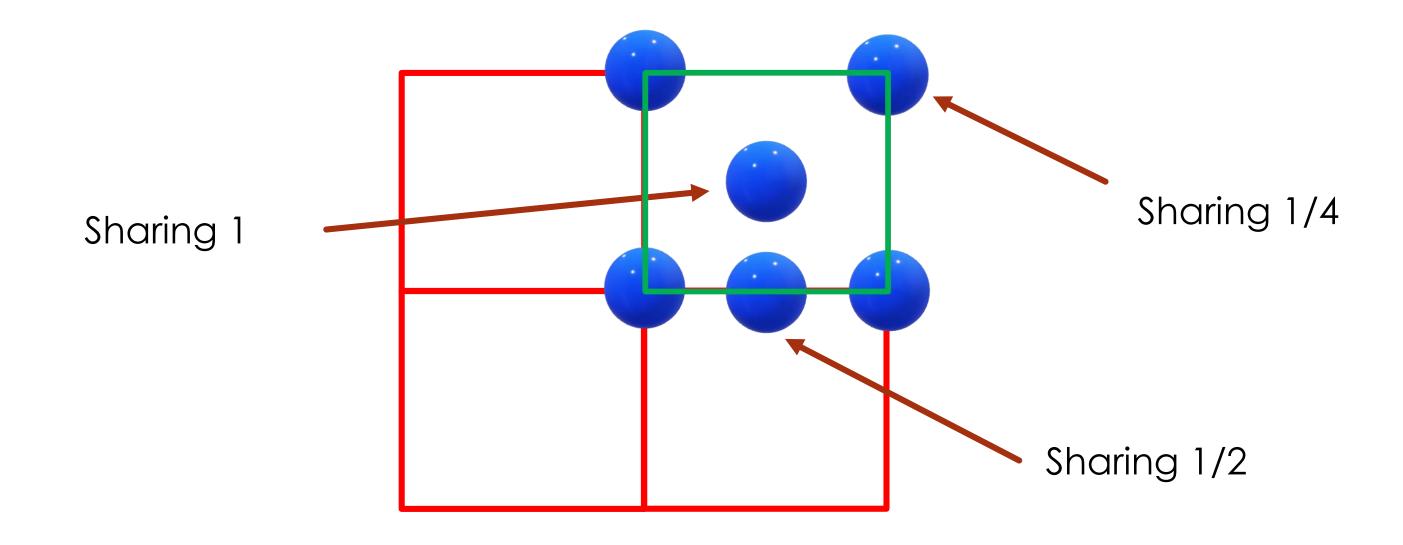


7 Different types of unit cells



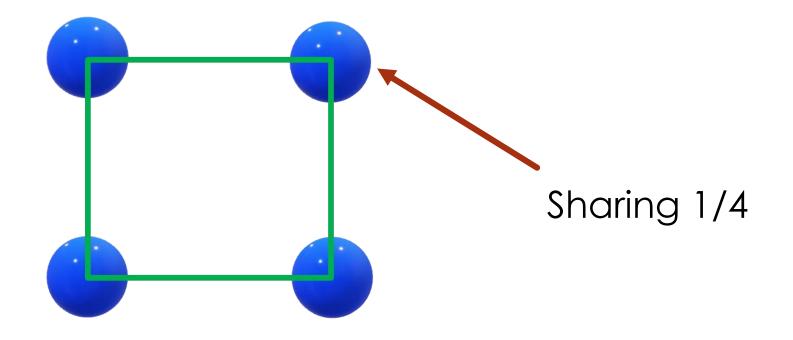
Crystal System	Lengths	Angles
Cubic	a=b=c	α=β=γ=90
Trigonal	a=b=c	a=β=γ<120, ≠90
Hexagonal	a=b≠c	$a=\beta=90, \gamma=120$
Tetragonal	a=b≠c	$a=\beta=\gamma=90$
Orthorhombic	a≠b≠c	$a=\beta=\gamma=90$
Monoclinic	a≠b≠c	a=β=90≠γ
Triclinic	a≠b≠c	a≠β≠γ







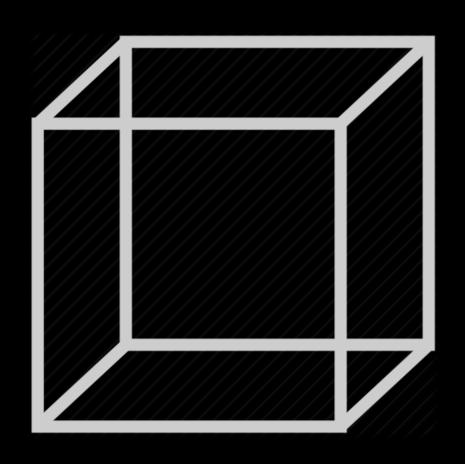
A Lattice with only lattice point



Sharing in a unit cell 1/4 * 4 = 1

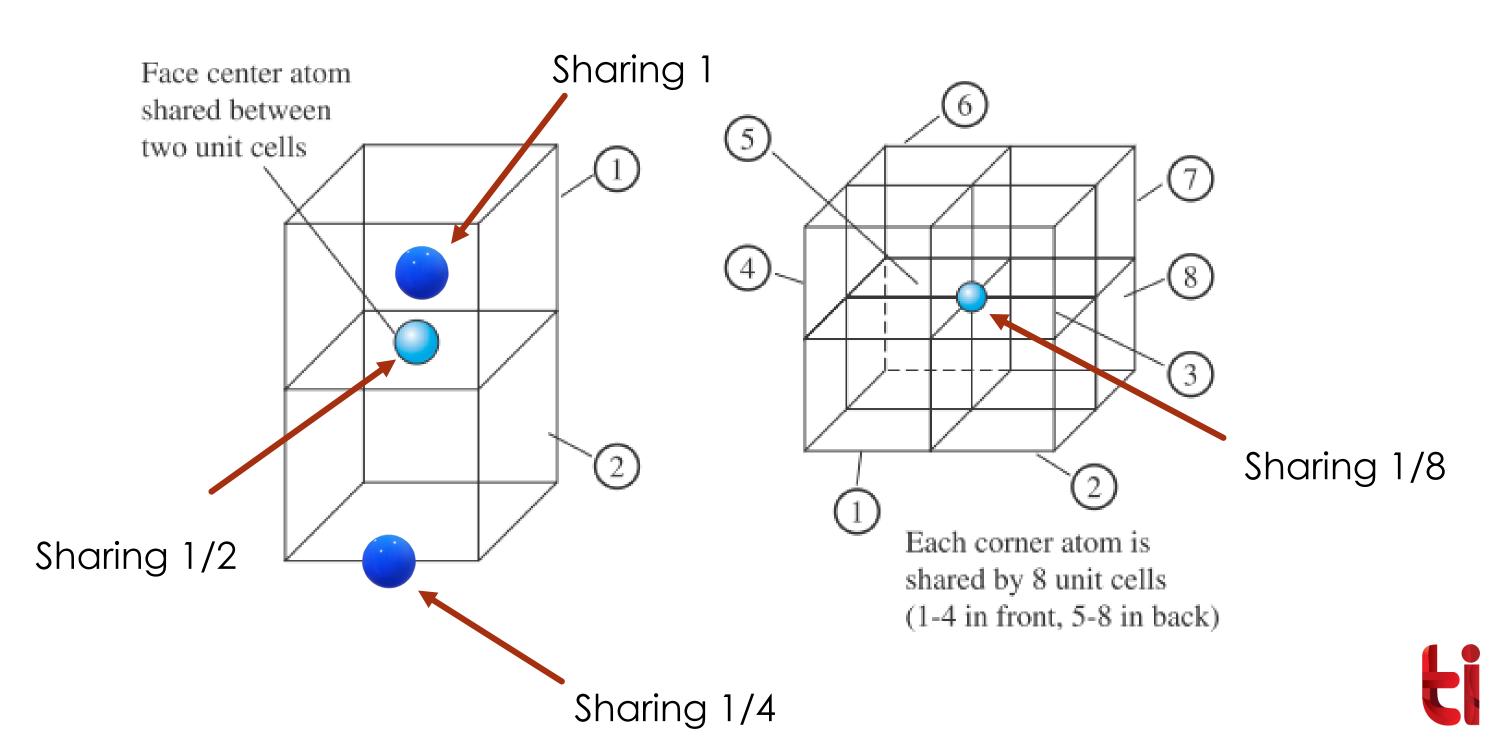


In a cubic unit cell (Try it yourself)

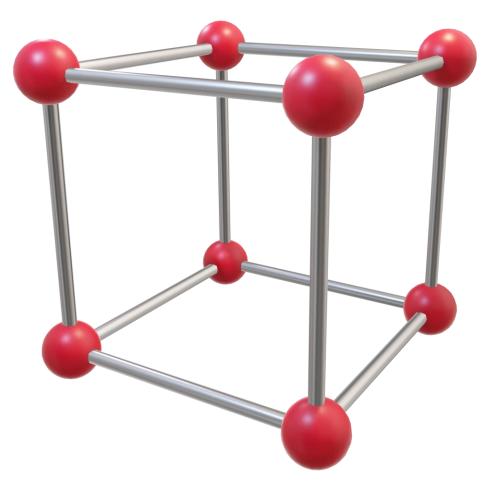


No. of. corners:	8
No. of edges:	12
No. of Faces:	6
No. of Body Diagonals:	4
No. of Face Diagonals:	12





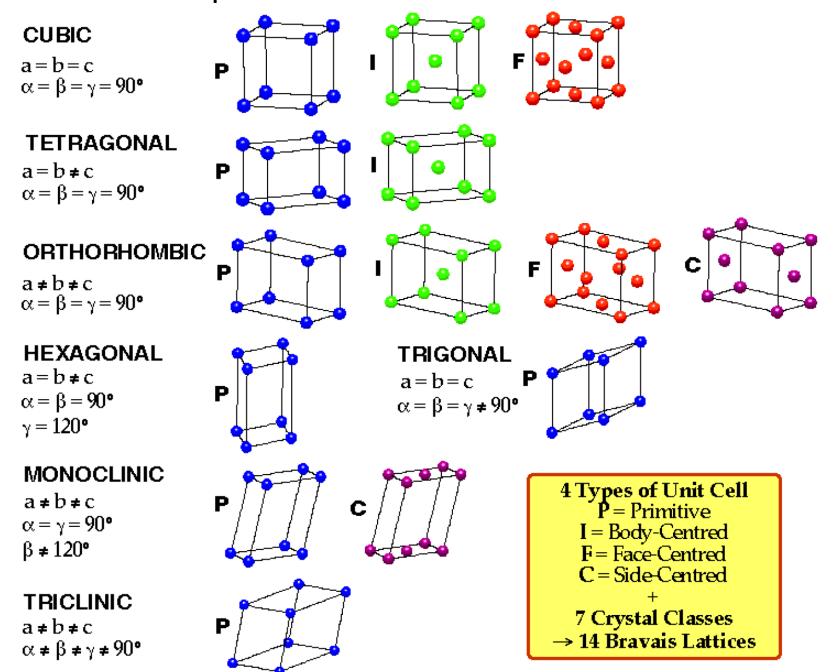
A Lattice with only lattice point



Sharing in a unit cell 1/8 * 8 = 1



There are only 14 ways of arranging lattice so that environment looks same from each point





Summary

- 1. Single crystalline or monocrystalline materials have periodic arrangement of atoms throughout.
- 2. A polycrystalline material consists of many single crystallite with a boundary.
- 3. Amorphous materials have random arrangement of atoms.
- 4. There are 7 crystal systems and 14 Bravais lattices.
- 5. The atom sitting in the unit cell can share different part depending upon its location.
- 6. A primitive lattice has only one lattice point in the unit cell.



Assignments

- 1. Why a 2-D pentagon lattice is not possible?
- 2. Which crystal systems are the least and most symmetric. Explain the reason.
- 3. Show that FCT does not exist in Bravais Lattice list.
- 4. Find out the number of lattice points in SC, BCC and FCC lattices.
- 5. Write down types of bonds present in different materials.
- 6. Find out 2-D primitive lattices in following pictures.

