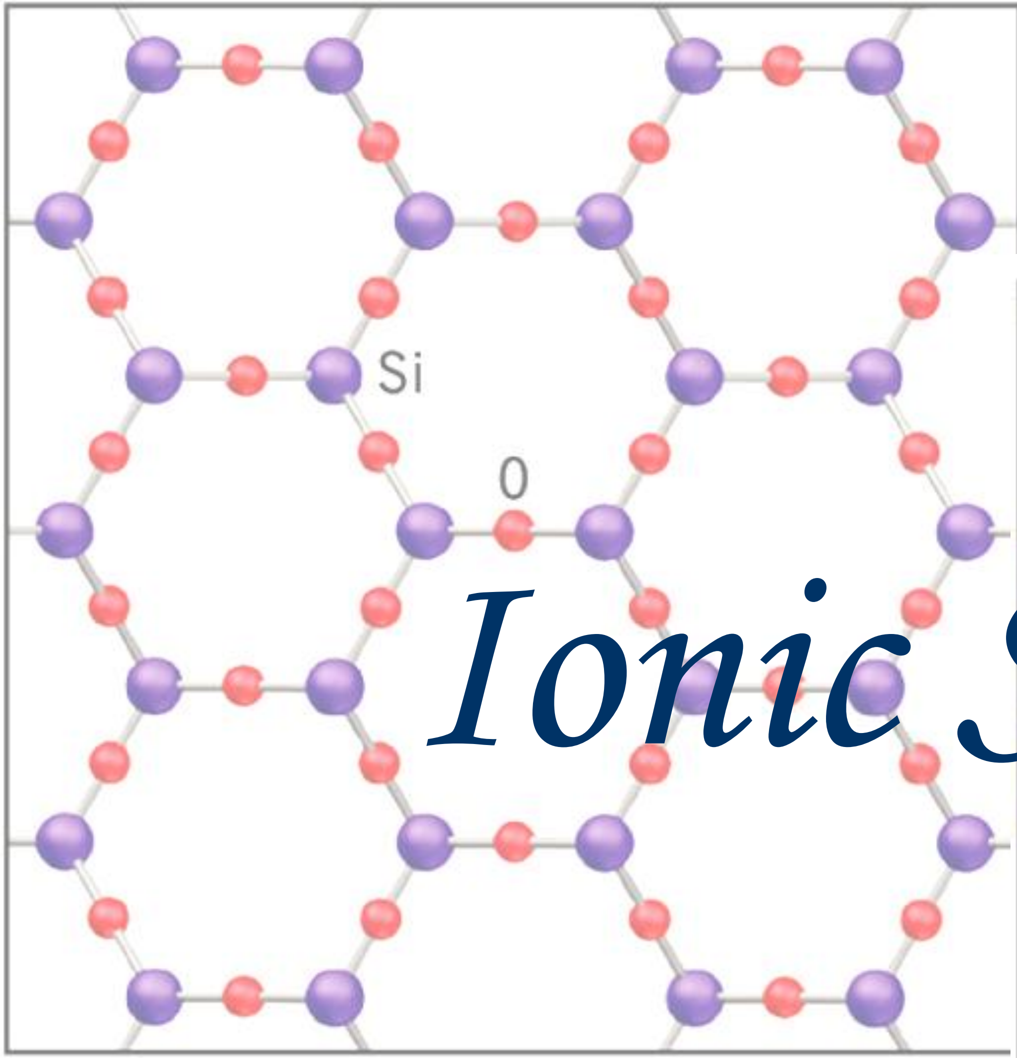
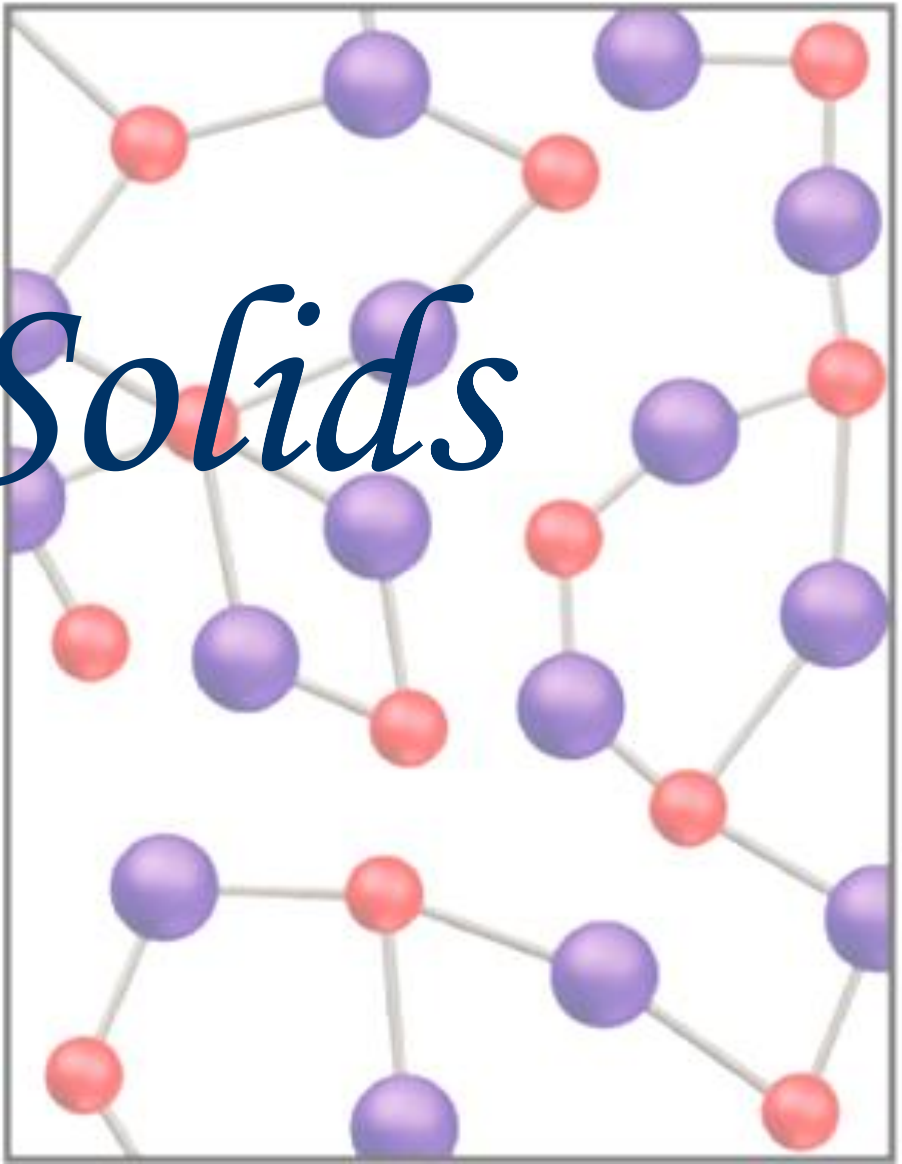
Ionic Solids



Crystalline

Amorphous



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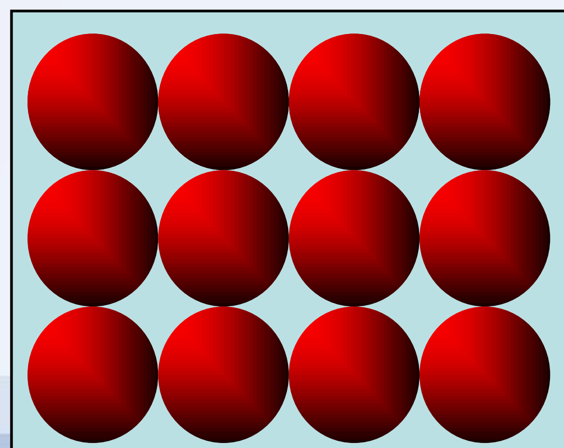
Categories of solids

Categories of solids based on the particles that form the solid pack

1. Crystalline solids
2. Amorphous solids
3. Polycrystalline solids

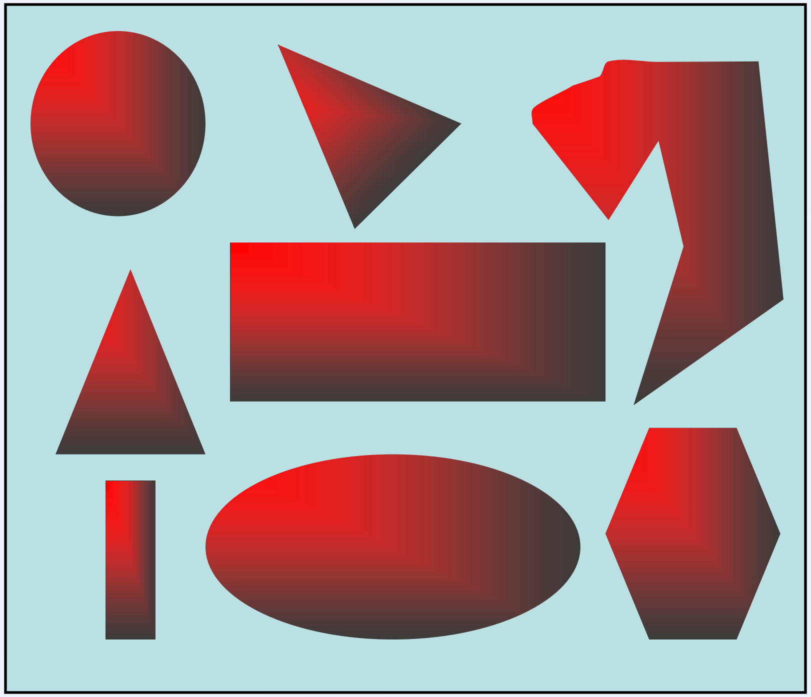
Crystalline solids

- Three-dimensional analogs of a brick wall.
- They have a regular structure, in which the particles pack in a repeating pattern from one edge of the solid to the other.



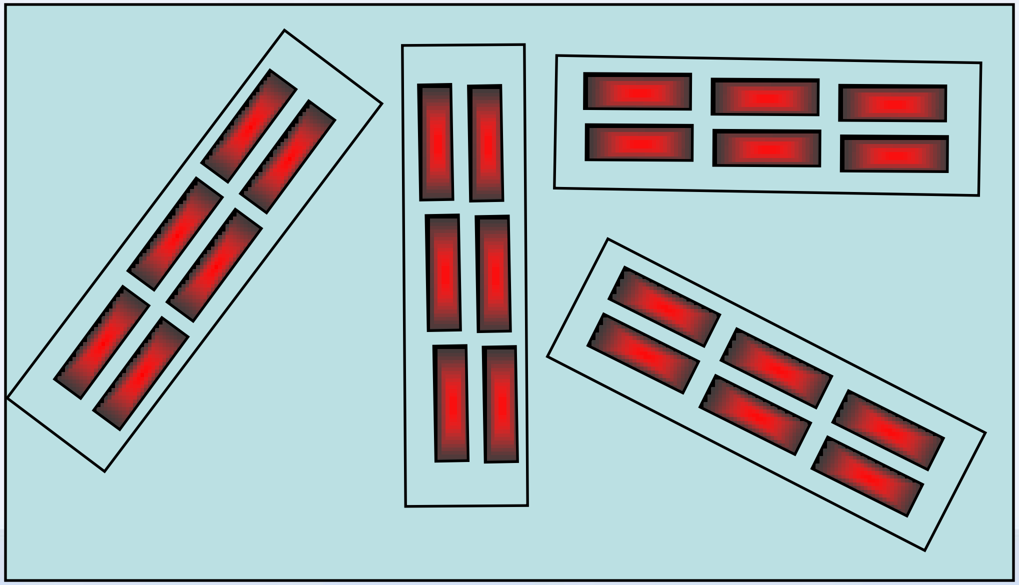
Amorphous solids

- (literally, "solids without form") have a random structure.



Polycrystalline solids

- Aggregate of a large number of small crystals or grains in which the structure is regular, but the crystals or grains are arranged in a random fashion.



Categories of solids

Categories of solids based on bonds that hold the solid together

1. Molecular
2. Covalent
3. Ionic
4. Metallic

Molecular solids

- Intramolecular bonds between the atoms that form the molecules >>>
- intermolecular bonds between these molecules <<<
- Soft substances with low melting points.

Molecular solids

- Example: dry ice, or solid carbon dioxide
- The van der Waals forces holding the CO_2 molecules together are weak enough that dry ice sublimesit passes directly from the solid to the gas phase at -78^{o}C.

Covalent solids

- Can be viewed as a single giant molecule made up of an almost endless number of covalent bonds.
- Example: diamond

Diamond

- Each carbon atom in diamond is covalently bound to four other carbon atoms oriented toward the corners of a tetrahedron

- Because all of the bonds in this structure are equally strong, covalent solids are often very hard and they are notoriously difficult to melt.

Ionic solids

- Held together by the strong force of attraction between ions of opposite charge.

- The strength of an ionic bond depends on the radii of the ions that form the solid.

Ionic solids

- As these ions become larger, the bond becomes weaker.

- But the ionic bond is still strong enough to ensure that salts have relatively high melting points and boiling points.

- Example: NaCl

Metallic solids

- Metal atoms don't have enough electrons to fill their valence shells by sharing electrons with their immediate neighbors.

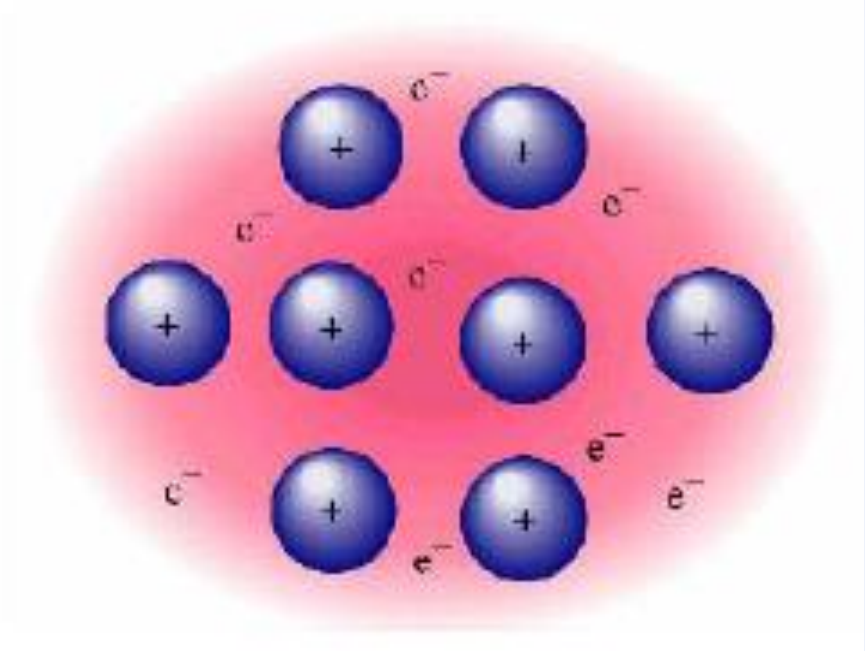
- Electrons in the valence shell are therefore shared by many atoms, instead of just two.

- In effect, the valence electrons are delocalized over many metal atoms.

Metallic solids

- Because these electrons aren't tightly bound to individual atoms, they are free to migrate through the metal.
- As a result, metals are good conductors of electricity.
- Electrons that enter the metal at one edge can displace other electrons to give rise to a net flow of electrons through the metal.

Metallic solids



- Bonds in the solid can be:
  - Very strong
    - m.p of W = 3422^{o}C
  - Very weak
    - m.p of Hg = -38^{o}C