Covalent Network Substances

2D and 3D

Covalent network substance

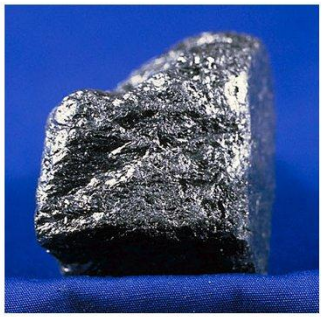
- Particles consist of single atoms
- Particles are held together by VERY strong covalent bond
- This attraction is stronger than electrostatic attractions in metallic and ionic solid

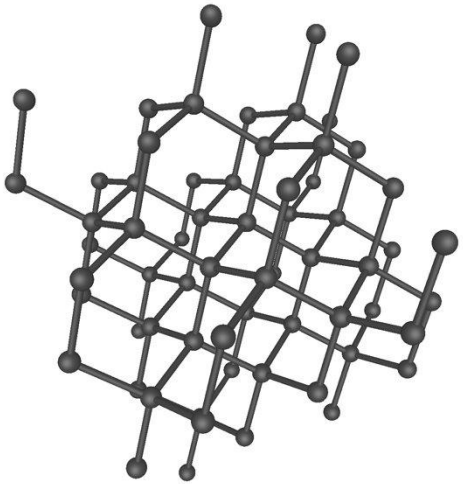
Graphite 2D

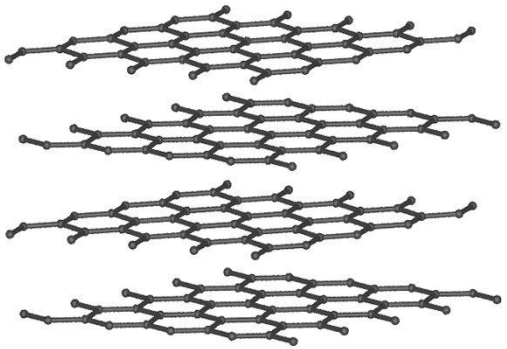
- In graphite, each carbon atom is held by a covalent bond to three other carbon atoms. In a **trigonal planer** style.
- This results in **two dimensional layers of hexagons**.
  - This used up three valence electrons
- The **forth valence electrons** are “shared” **between the layers** holding the layers together.
- The bonding **between** each **layer** is **weak** but **within the layer** is **strong.**
- Because **the electrons between the layers are mobile**, therefore **graphite** is an **electrical conductor**.
- Also because **the force between the layer is weak**, therefore graphite’s layer **can slide between** each other. (Can be used **as lubricant**)

Diamond 3D

- In **diamond,** each carbon atom is held by a covalent bond to four other carbon atoms in the shape of **tetrahedral**. The structure is continuous in **three dimensions**.
- Another example of **Giant molecular structure** is **Silicon Dioxide SiO_2**
  - Each Silicon bonded with 4 oxygen and each oxygen bonded to two silicon







Allotrope

- Allotrope is any of the different physical forms of an **element**.
- Carbon- diamond, graphite, C_{60}
- Oxygen- Ozone, oxygen

- Note-
  - Allotrope only applies for elements
  - Although Calcium carbonate can exist in a form of limestone or marble… because it is a compound… you cannot call it an allotrope

Polymer

- Atoms (monomer) are join together and extend in a one dimension and produce a very long molecule.
- Because it is a VERY long molecule, therefore it is nearly impossible (with exception) for the particles to arrange themselves forming crystals.
- As a result it exist in a “supercool liquid” state (just like glass).
- This state is called **amorphous**
  - It is sort of like noodles…