COVALENT NETWORK SOLIDS (e.g. graphite, diamond, silica)

Particles
- Atoms (Carbon atoms in Graphite and Diamond)
- Atoms (Silicon and Oxygen in Silica, SiO_2)

Forces between particles
- **Very strong**, **highly directional covalent** bonds between atoms.

- **Solubility of all covalent network solids**
  - Covalent network solids do not dissolve in any solvents.
  - The covalent bonds between atoms are much stronger than the forces of attraction any solvent has for the solid.

CASE STUDIES

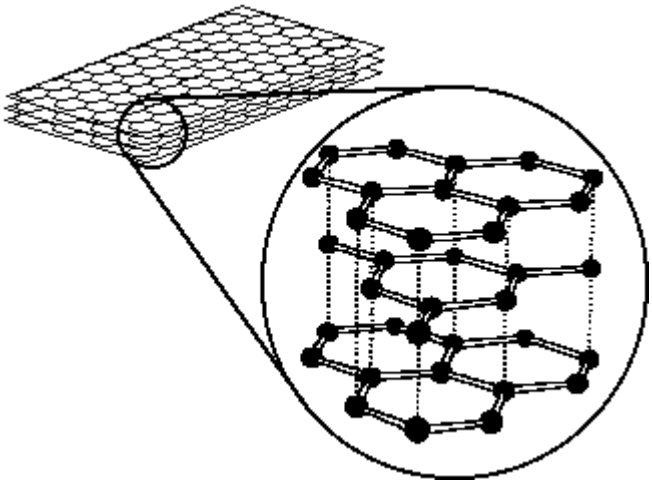
- **DIAMOND (particles - carbon atoms)**
  - **3D network** of carbon **atoms** all covalently bonded to **4** other carbon atoms in an **extended tetrahedral network**
  - Extremely **hard** and has a **extremely high melting/boiling point** due to its rigid, highly directional 3D covalent structure (4 covalent bonds for each carbon atom)
  - **Non – conducting of electricity**: no free electrons / charged particles as all 4 of carbons bonds are satisfied
  - Uses: drill tips in industrial saws

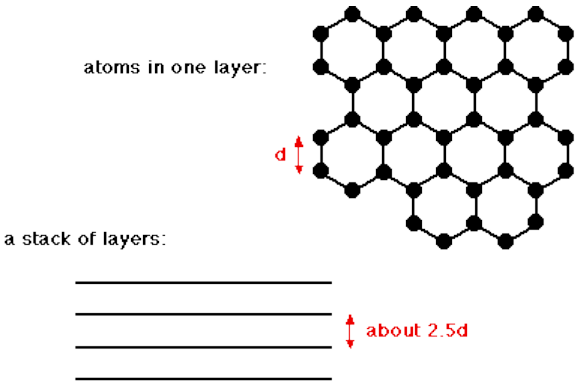
- **GRAPHITE (carbon atoms)**
  - **2D network** of carbon **atoms** all covalently bonded to **3** other carbon atoms in "flat**, hexagonal sheets**".
  - Sheets are held together by **weak intermolecular forces**. Sheets can slide over each other due to these weak forces taking little heat energy to break. Therefore graphite is '**soft**' and used as lead in pencils and as a lubricant
  - **Very high melting point**(not as high as diamond as there are 3 covalent bonds per atom to break compared to diamonds 4)
  - **Conducts electricity**: Carbon can form 4 covalent bonds but only has 3 in Graphite. The spare electron for each carbon atom is free to move (delocalised) and carry electricity. Graphite is the only non-metal conductor.
  - **Uses:** electrodes, pencils, industrial lubricant

- **SILICA $(SiO_2)_n$ - also called Quartz**
  - Same structure and properties diamond (tetrahedral covalent network). Only difference is that it is silicon and oxygen atoms) in the extended network, not carbon

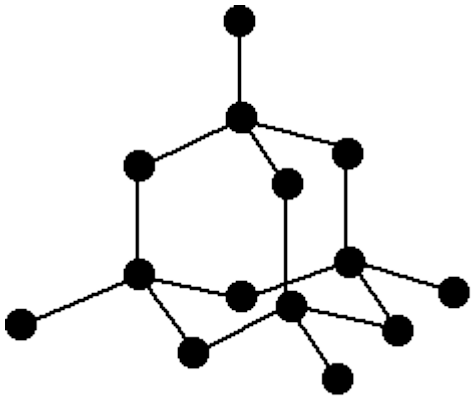
Covalent Network Solids

Graphite





Diamond



Silica (SiO_2)