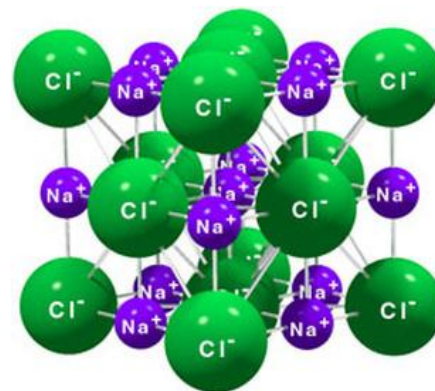


4.8 THE STRUCTURE AND PROPERTIES OF SOLIDS

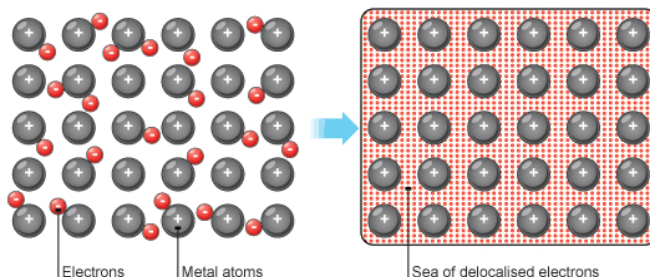
IONIC CRYSTALS

- Ionic crystals are built up from an alternating sequence of _____
- _____
- Ions arrange themselves in a solid to _____ between oppositely charged ions and _____ between like charges
- The type of packing and the shape of the crystal depends on the relative _____ and _____ of the ions
- Ionic solids are _____
- _____ do not conduct electricity, but in _____, or in _____ they do conduct electricity
- Ionic crystals have high _____ (because of the strong ionic bonds) (Bond Energy: 400-4000 kJ/mol)

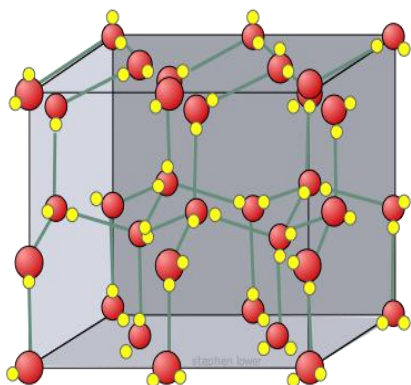


METALLIC CRYSTALS

- Not all metallic crystals have similar physical properties
- Metallic crystals are made up of closely packed atoms whose valence electrons _____ around the positively charged nuclei (electron sea theory)
- The free floating electrons move around many nuclei and hold multiple positive nuclei together
- Metallic bond is due to _____ attraction between the _____ and the sea of _____ (75-1000 kJ/mol)
- The metal atoms involved in metallic bonding must have a low _____ (since they do not hold on to their electrons strongly and electrons move beyond valence shells)
- **Lustre** - valence electrons _____ and _____ the energy of all wavelengths of light
- **Electrical Conductivity** - when an electrical force is applied, the _____
- **Heat Conductivity** - heat applied to one section of a metal _____ of electrons at this point. This motion is transmitted to nearby electrons and the motion (_____) of the rapidly travelling electrons results in the heating of other parts of the crystal
- **Malleability/Ductility** - metals are malleable and ductile
- **Hardness** - Strong _____ between positively charged nuclei and sea of electrons



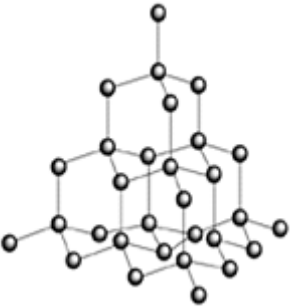
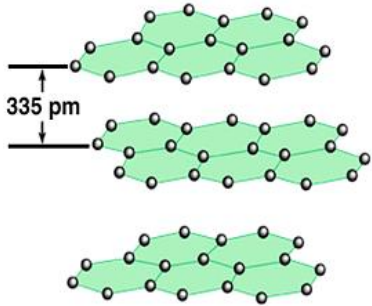
MOLECULAR CRYSTALS



- Molecular crystals are held together in _____
- _____
- Certain substances form molecular crystals in the solid state and certain substances can form variations of crystals
- A molecular crystal is a solid crystal that consists of molecules held together by _____
- Polar molecules are held together by _____ (some polar molecules are held together by _____) and _____
- Non-polar molecules are held together by _____
- These crystals do not conduct electricity, because they are composed of _____ molecules (both in solid and solution form)

COVALENT NETWORK CRYSTALS

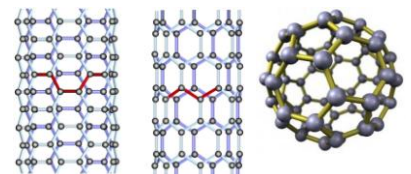
- As the name suggests, these crystals consist of _____ bonds that are organized into an _____ and _____ network
- Covalent Network Crystals have _____ melting points and are very hard because of the interlocking network of many carbons arranged in a variety of geometries
- These crystals are _____ conductors of electricity, because the atoms and covalent bonds hold electrons in space

	Diamond	Graphite
Structure	3-D; each carbon is _____ (bonded to 4 C)	- 3-D; each carbon is _____ (bonded to 3 C) - Arranged in _____ - _____ hold carbons together within a later - _____ hold layers together
Hardness		
Melting Point		
Electrical Conductivity		_____ (consists of free mobile electrons from p orbital)
Uses	Gem stones, cutting, drilling	Lubricant for machines at high temp, pencils, electrodes, sporting equipment
Image		

Other Examples of Covalent Network Crystals

_____ - Cage-like arrangement of 60 carbon atoms in a sphere or soccer-ball like structure

_____ - Similar to structure of graphite, except rolled in a cylinder



Most covalent networks are composed of _____ and _____. _____ and _____ is made up of silica (SiO_2). Quartz forms a structure similar to a typical network crystal. Glass is much more disordered. It is more like a viscous liquid than a crystal solid (it is the result of heating silica and cooling it rapidly). Additives are added to glass to make it stronger or to change other properties.

Semiconductors

These are covalent crystals consisting of _____ or _____ and conduct electricity at room temperature, but increase their _____ at higher _____. Many of these conductors have _____ and _____ additives which increase or decrease _____ and allow for more electron movement between atoms and excitation, increasing the _____ of the solid.

