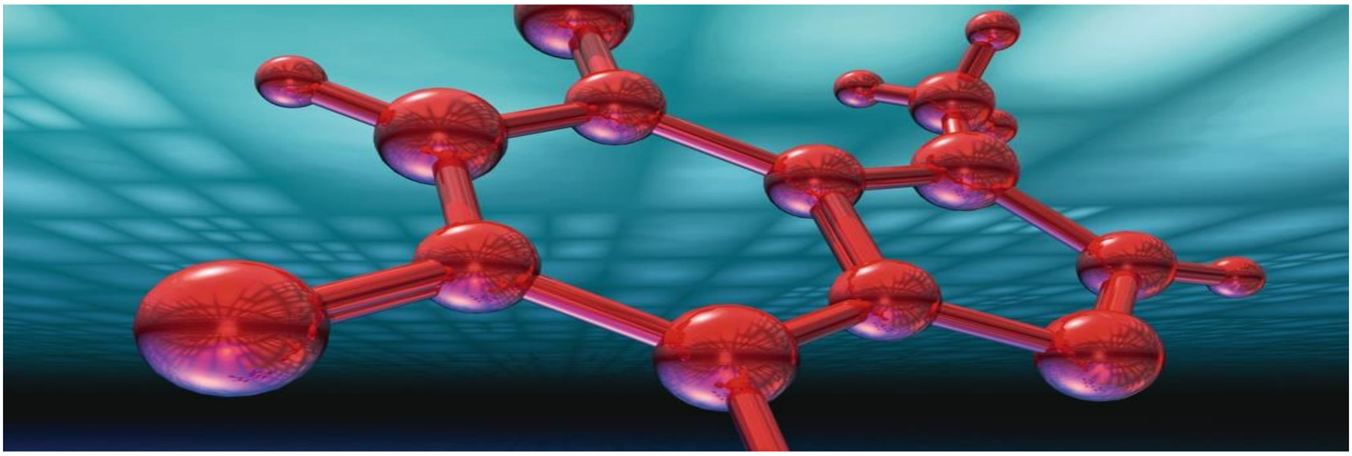


Lecture 2: Bonding & structure

Learning Objectives:

Ionic bonding:

- *Representing ionic bonds using dot and cross diagrams*
- *The structure of ionic compounds*
- *The properties of ionic compounds*

Covalent bonding:

- *The bonding, structure and properties of covalent compounds*
- *Dative bonding*
- *Types of intermolecular forces*

Metallic bonding:

- *The structure of metallic compounds*
- *The properties of metallic compounds*

Ionic compounds

Transfer of **electrons** from a **metal to a non-metal,** forming oppositely charged ions (**cations and anions**).

OCR definition: "The Electrostatic force of attraction between oppositely charged ions."

Draw dot & cross diagrams of…

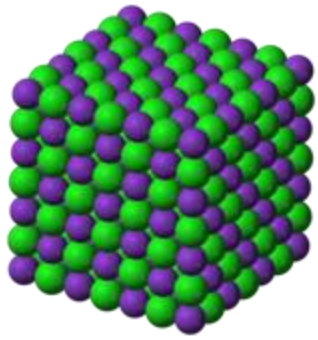
- Lithium fluoride
- Sodium phosphide
- Aluminium oxide
- Magnesium oxide
- Calcium bromide

Extension

Sodium cyanide

Hint: cyanide is $C\equiv N$

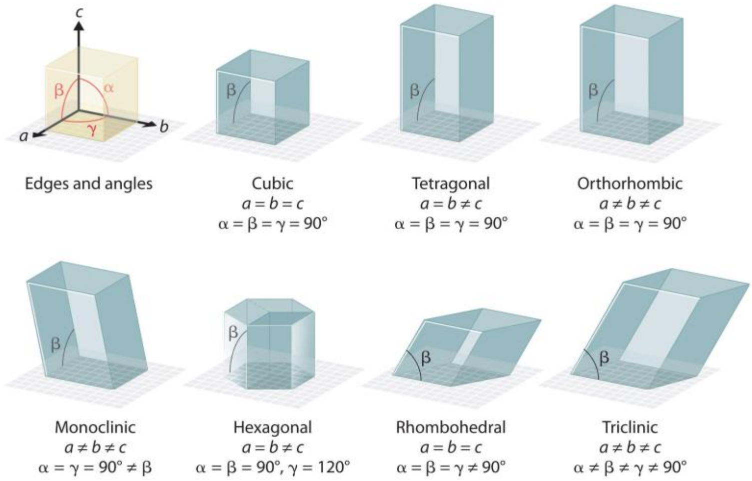
Giant ionic lattice



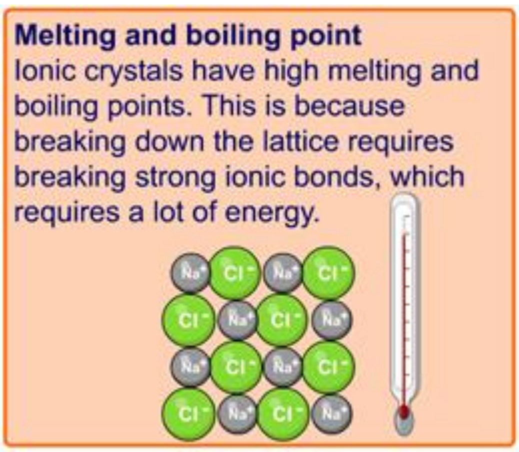
3D structure composed of oppositely charged ions in a uniform arrangement, held together by strong ionic bonds.

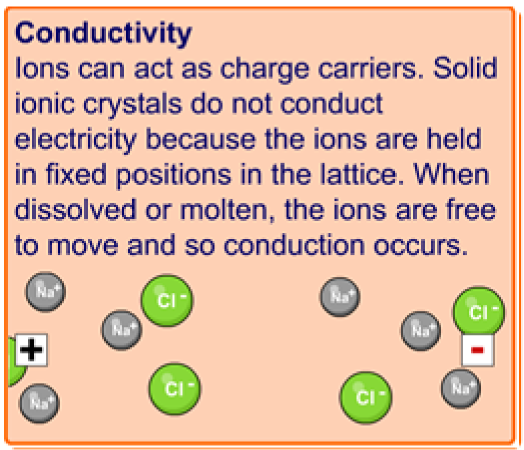
The electrostatic forces of attraction act in all directions.

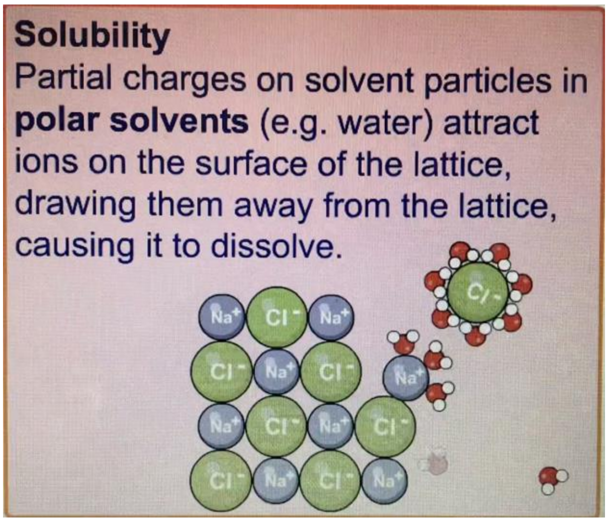
Crystals



Properties of ionic compounds







Covalent bonding

Shared pair of electrons (between two non-metals)

OCR definition: "The strong electrostatic attraction between a shared pair of electrons and the nuclei of the bonded atoms"

Draw dot & cross diagrams of:

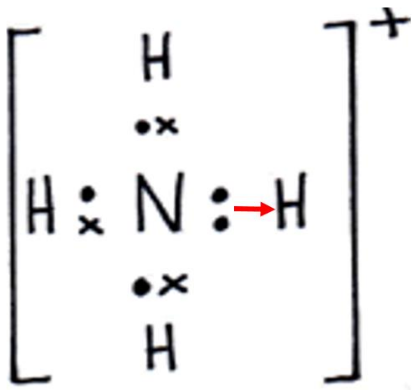
- Ammonia (NH_3)
- Methane (CH_4)
- Oxygen
- N_2
- SiF_4
- CS_2

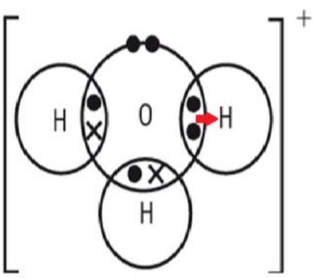
Extension
Sulfuric acid

Dative covalent bonding (Coordinate bonding)

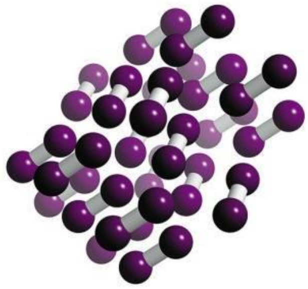
When one of the atoms in the bond provide both of the electrons.

An arrow shows which atom donates the electron





Simple molecular compounds



Compounds with a **set formula**

They form **simple molecular lattices when solid**

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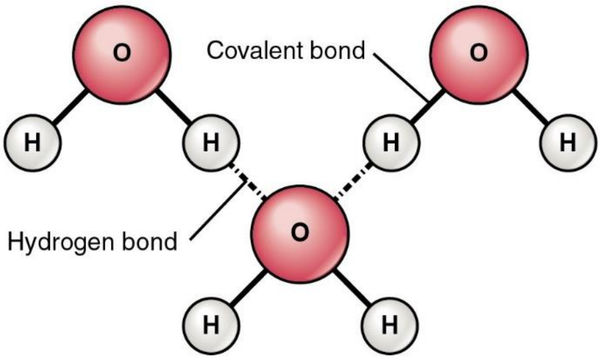
*The molecules are held within the lattice by relatively **weak intermolecular forces.***

Types of intermolecular forces, in order of increasing strength:

London forces

Permanent dipole-dipole interactions

Hydrogen bonding



London forces

- Weakest force
- Forms between all molecules

Permanent dipole-dipole interactions

- Stronger than London forces
- Only forms between some molecules

Hydrogen bonding

- Strongest type of intermolecular force
- form between a hydrogen of one molecule and a N,O or F of another.

Properties of simple molecular substances

Low melting & boiling point: Weak intermolecular forces require little energy to break.

Do not conduct electricity: No mobile charge carriers (no delocalised electrons or mobile ions).

Solubility: Varies depending on compound and solvent.

Giant Covalent lattices

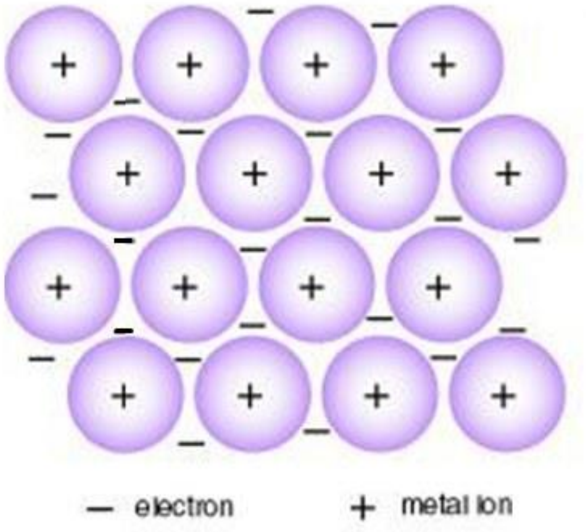
- Boron, carbon and silicon

- Made of billions of atoms so do not have a set formula

- Atoms are held together by a network of strong covalent bonds

Metallic bonding

"Strong electrostatic attraction between cations and delocalised electrons"



High melting & boiling point: *Strong electrostatic forces require lot of thermal energy to break. They are dependant on:*

1.**Charge:** a higher charge results in a higher m.p.

2. **Size of ion**: a bigger ion results in a lower boiling point

Does conduct electricity: *Due to delocalised electrons*

Insoluble: *Forces of attraction are too strong to be pulled apart by a solvent.*