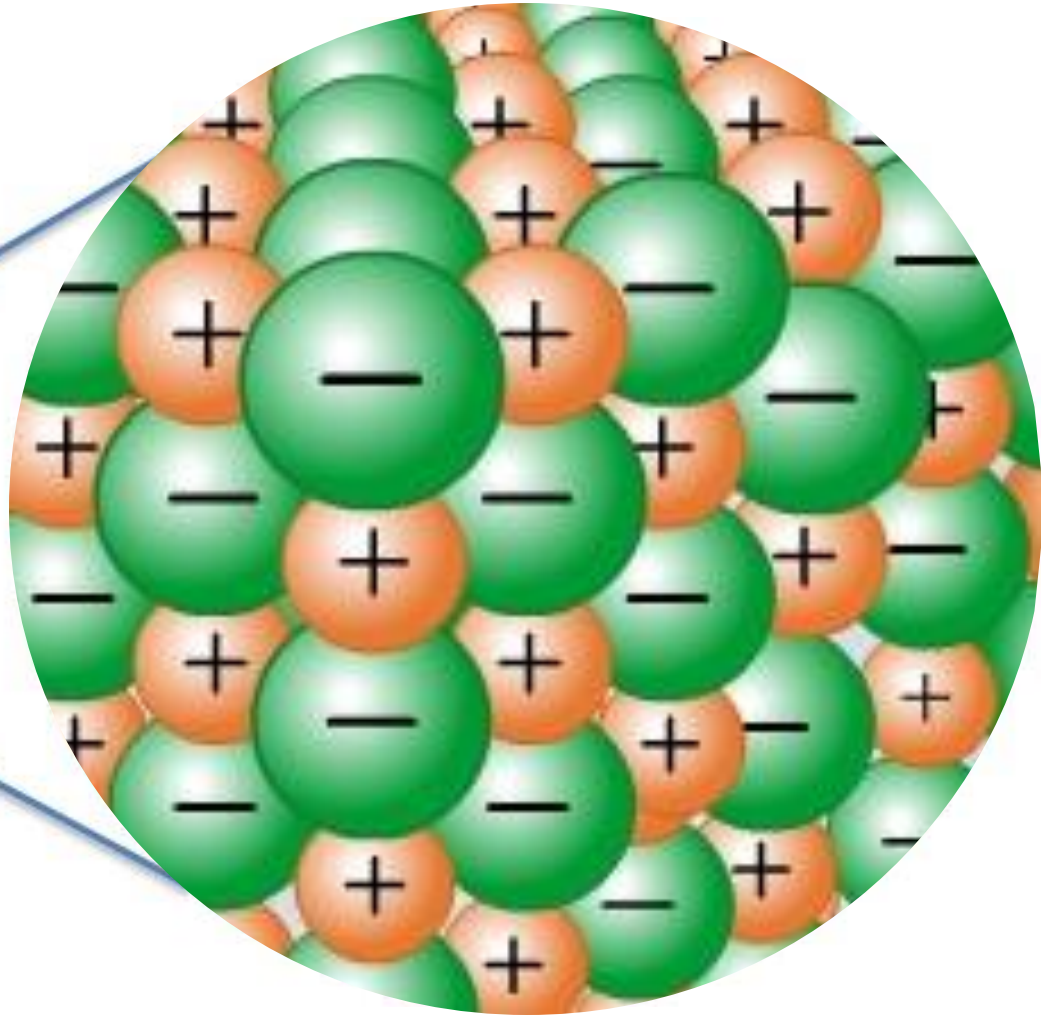
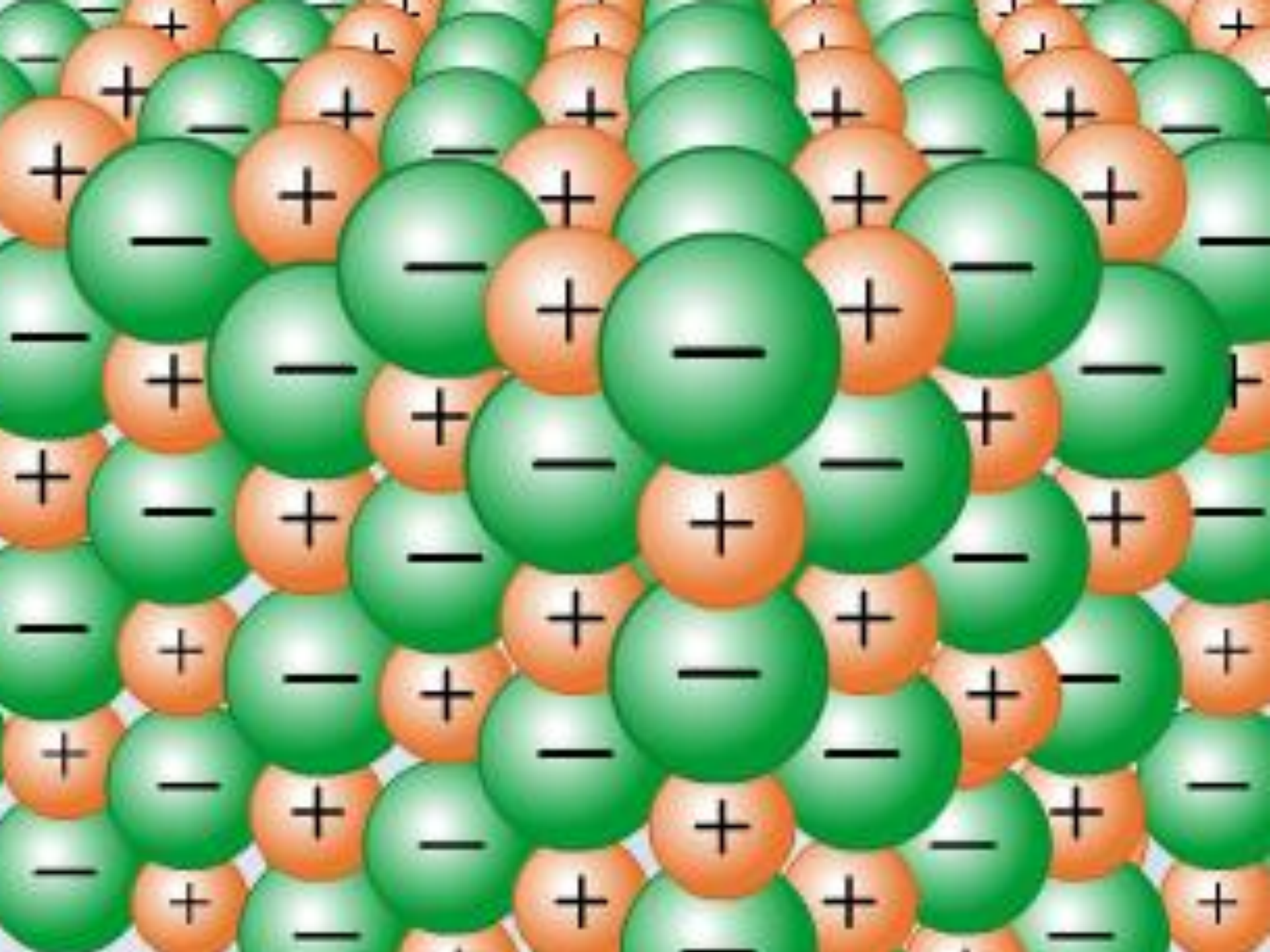
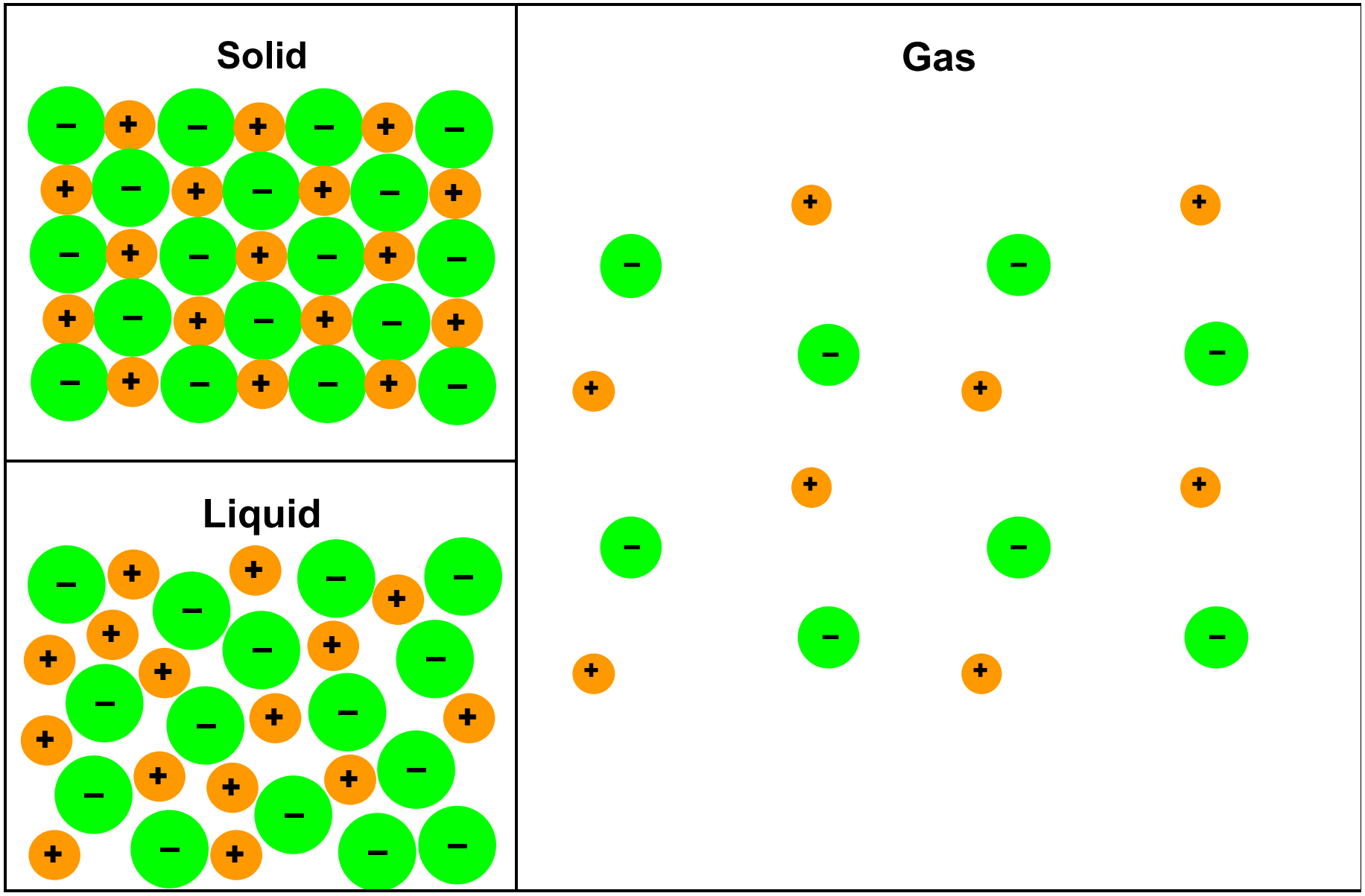
WWW.CHEMSHEETS.CO.UK

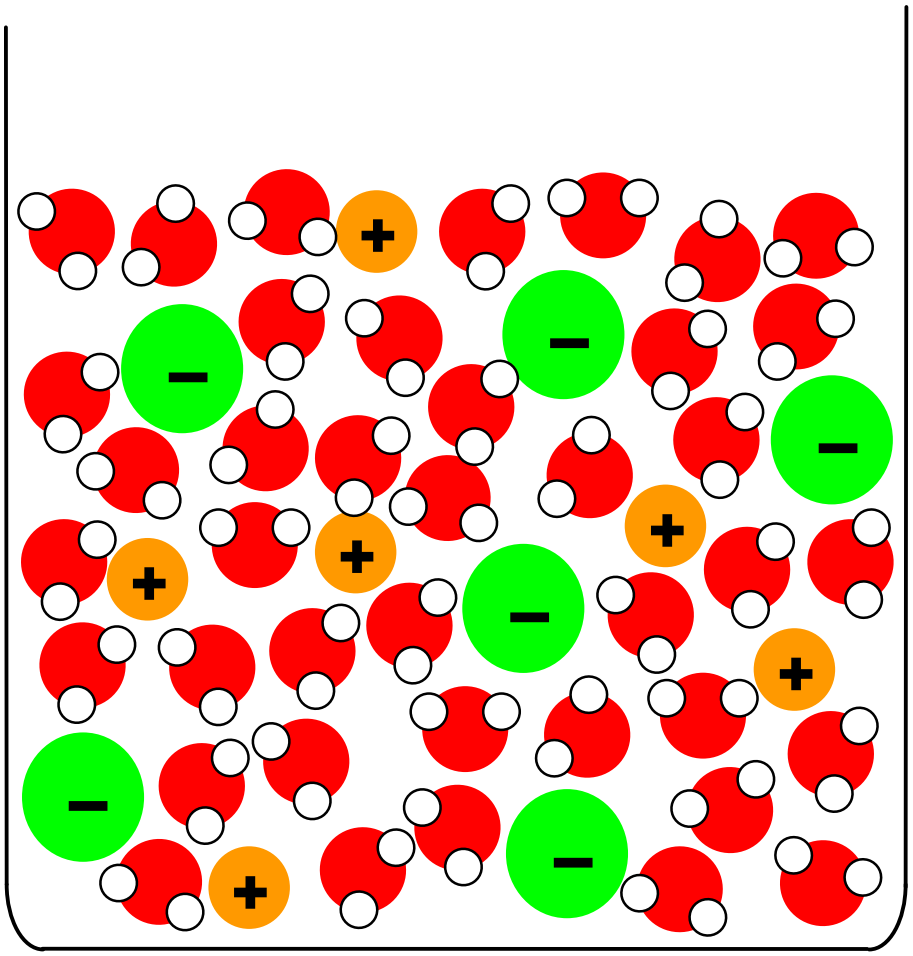
# STRUCTURE TYPES

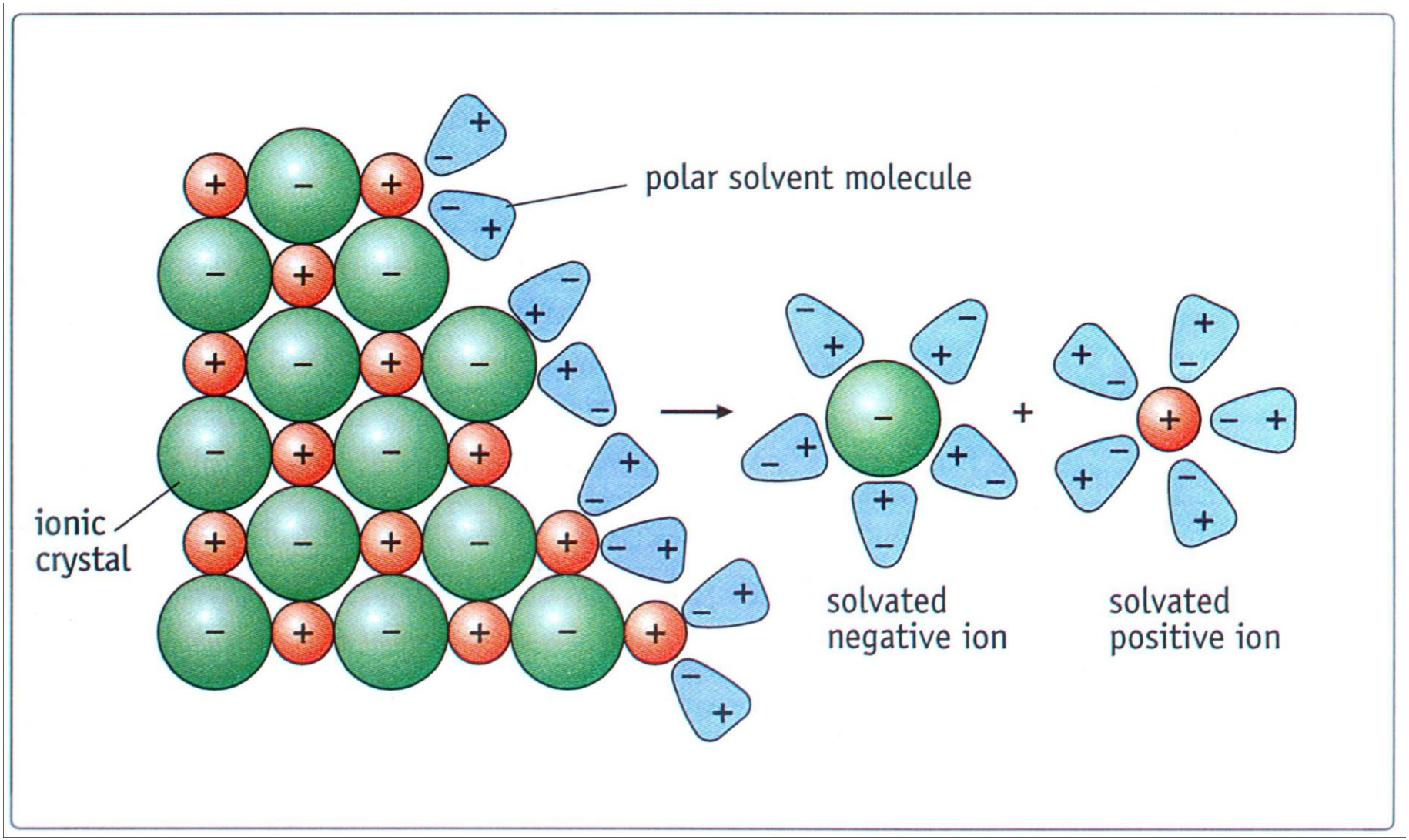
# IONIC e.g. NaCl

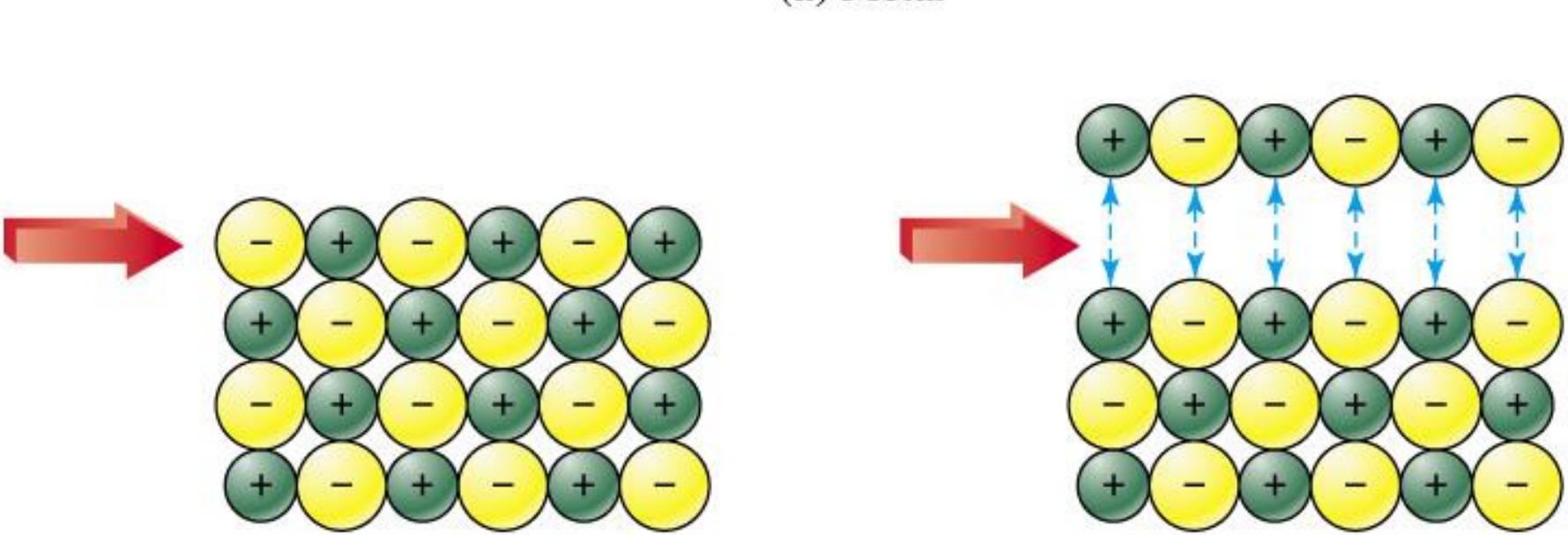




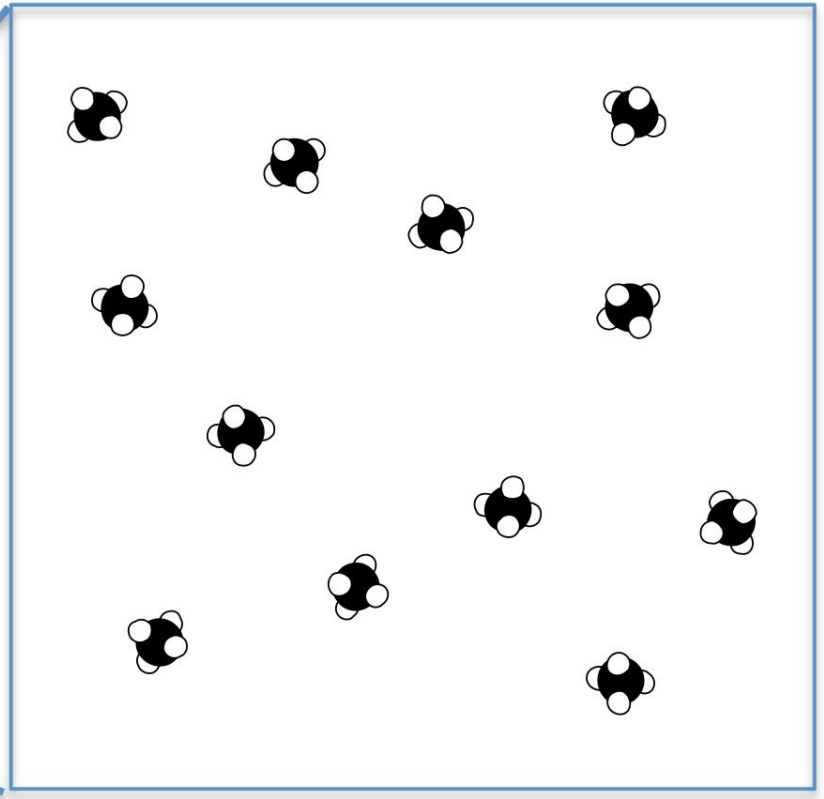

Solid
Liquid
Gas

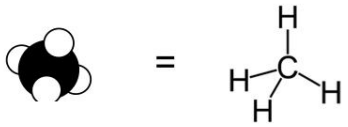



polar solvent molecule
ionic crystal
solvated negative ion
solvated positive ion

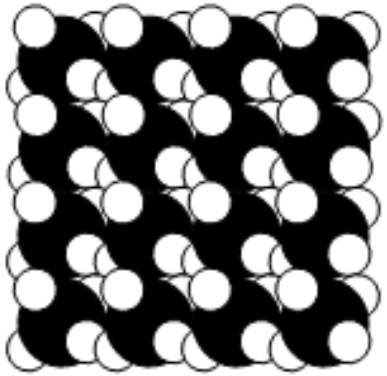
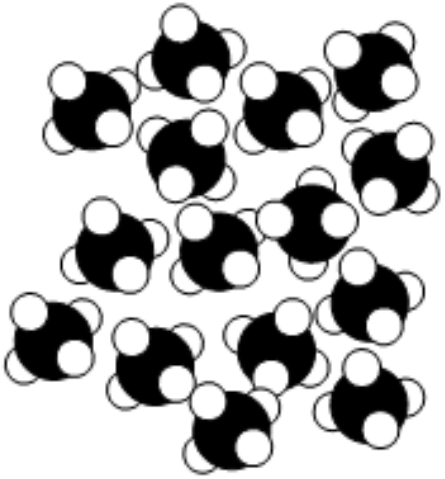
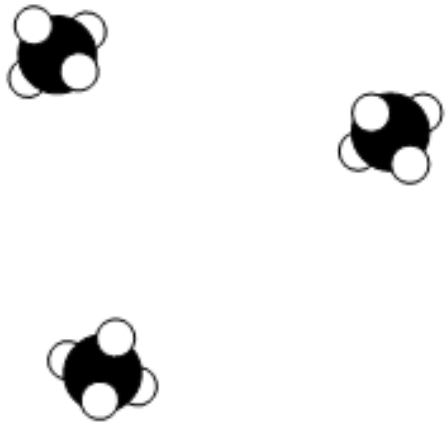
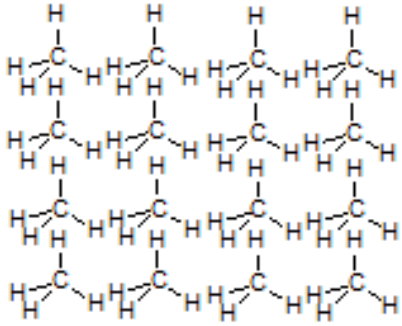
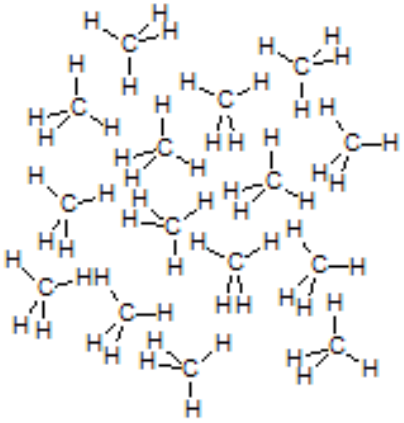
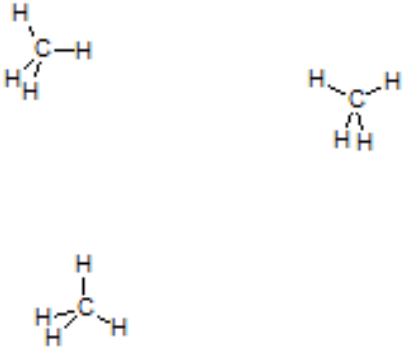

(a) Metal
(b) Ionic crystal

# SIMPLE MOLECULAR e.g. $CH_4$

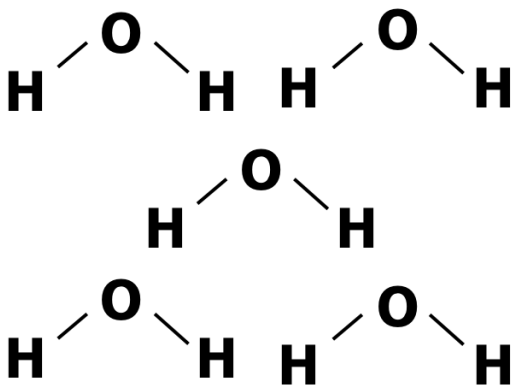




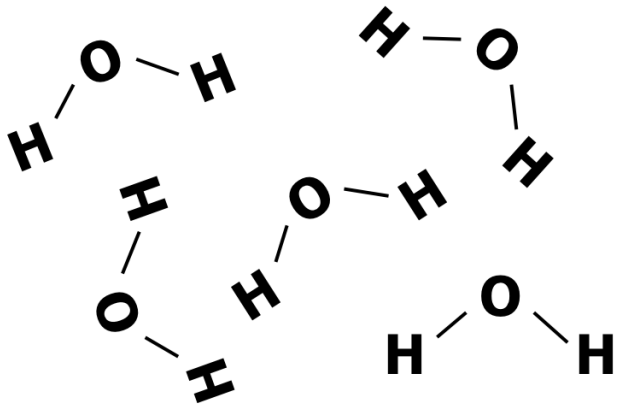
# SIMPLE MOLECULAR e.g. $CH_4$

| state | solid | liquid | gas |
|---|---|---|---|
| space-filling diagrams |  |  |  |
| stick diagrams |  |  |  |

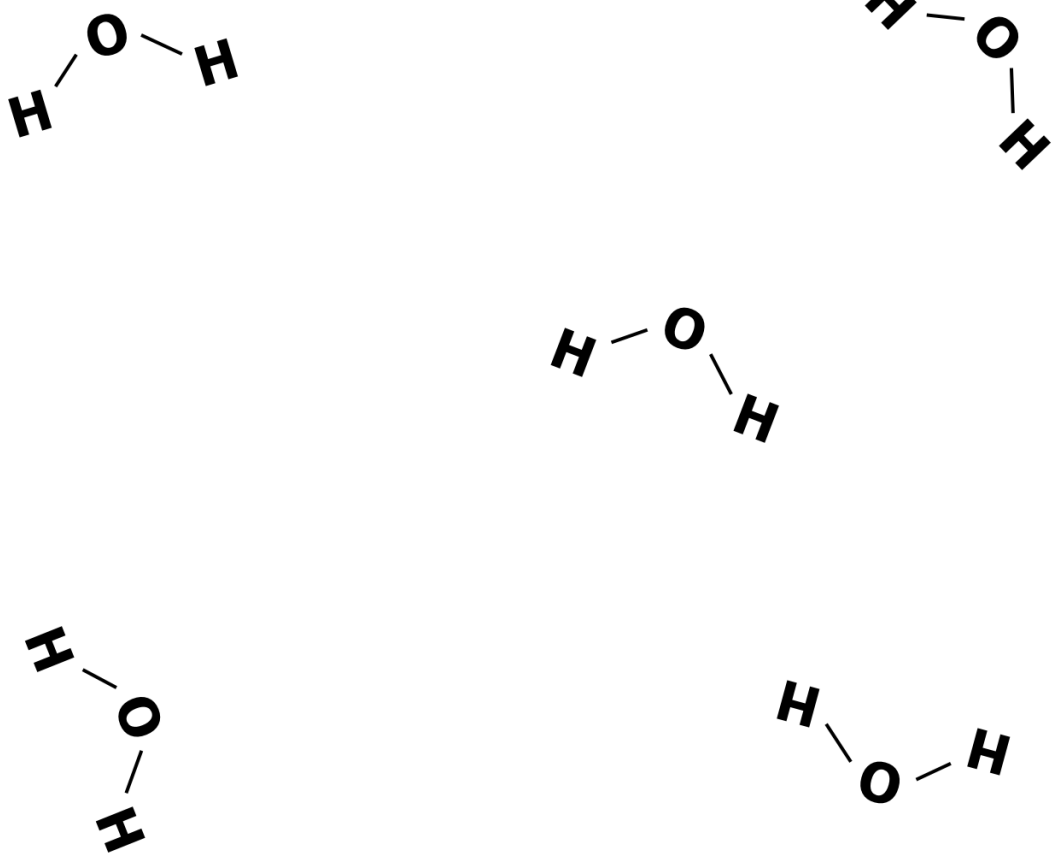
**Solid (Ice)**



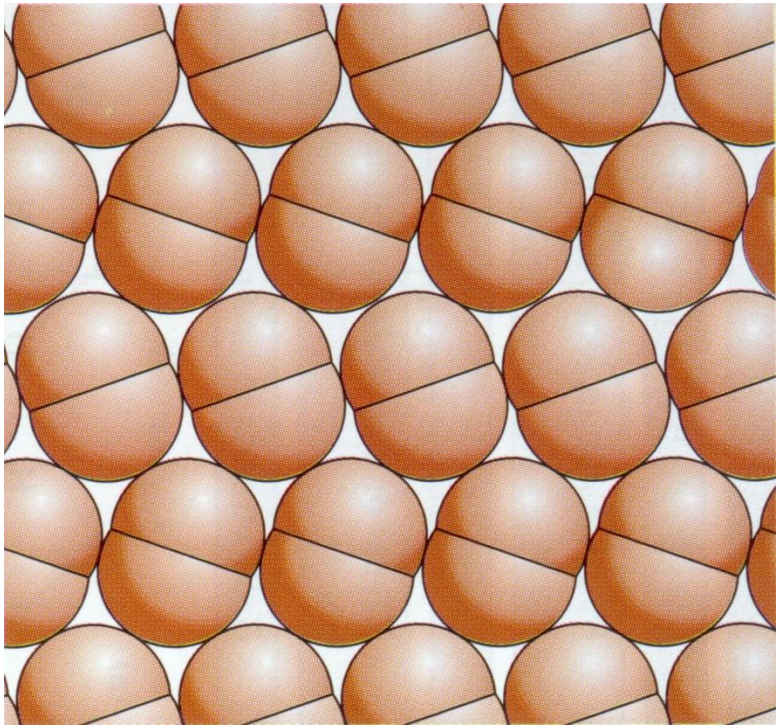
**Liquid (water)**

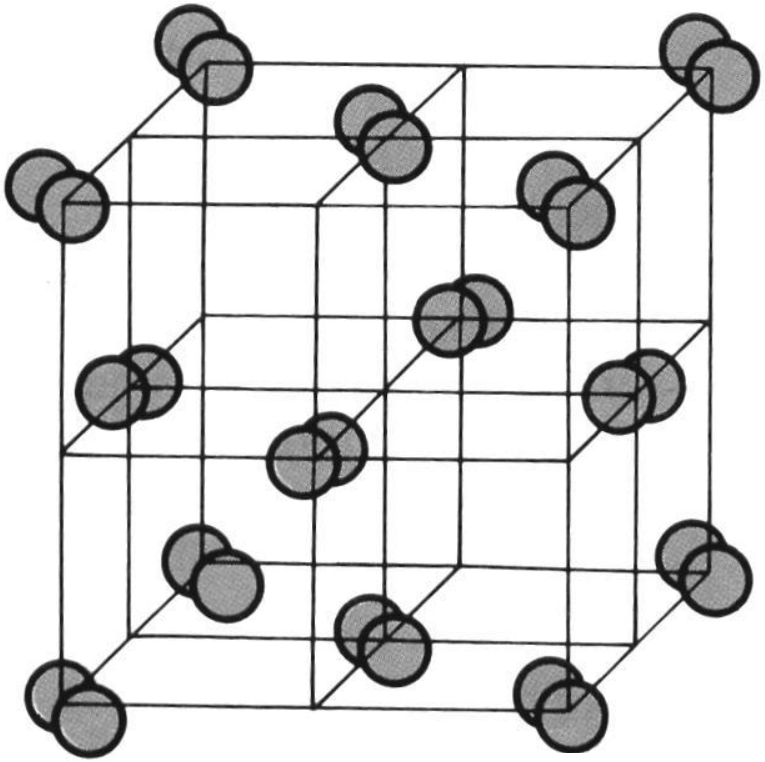


**Gas (steam)**



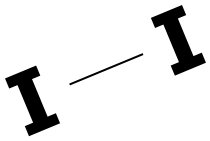
# SIMPLE MOLECULAR e.g. $I_2$

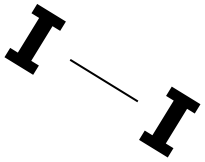


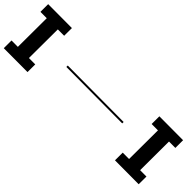


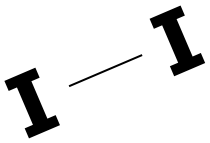
indicates the centre of an $I_2$ molecule

## GAS $I_2$

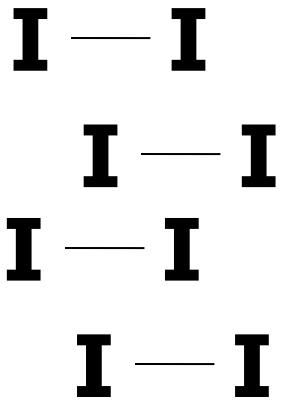




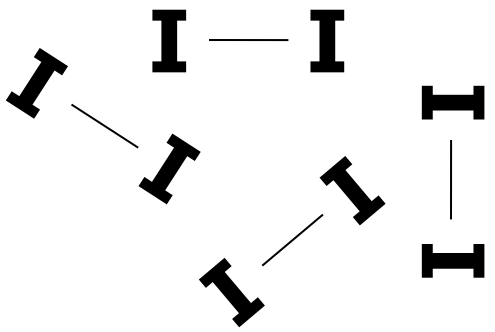




## SOLID $I_2$

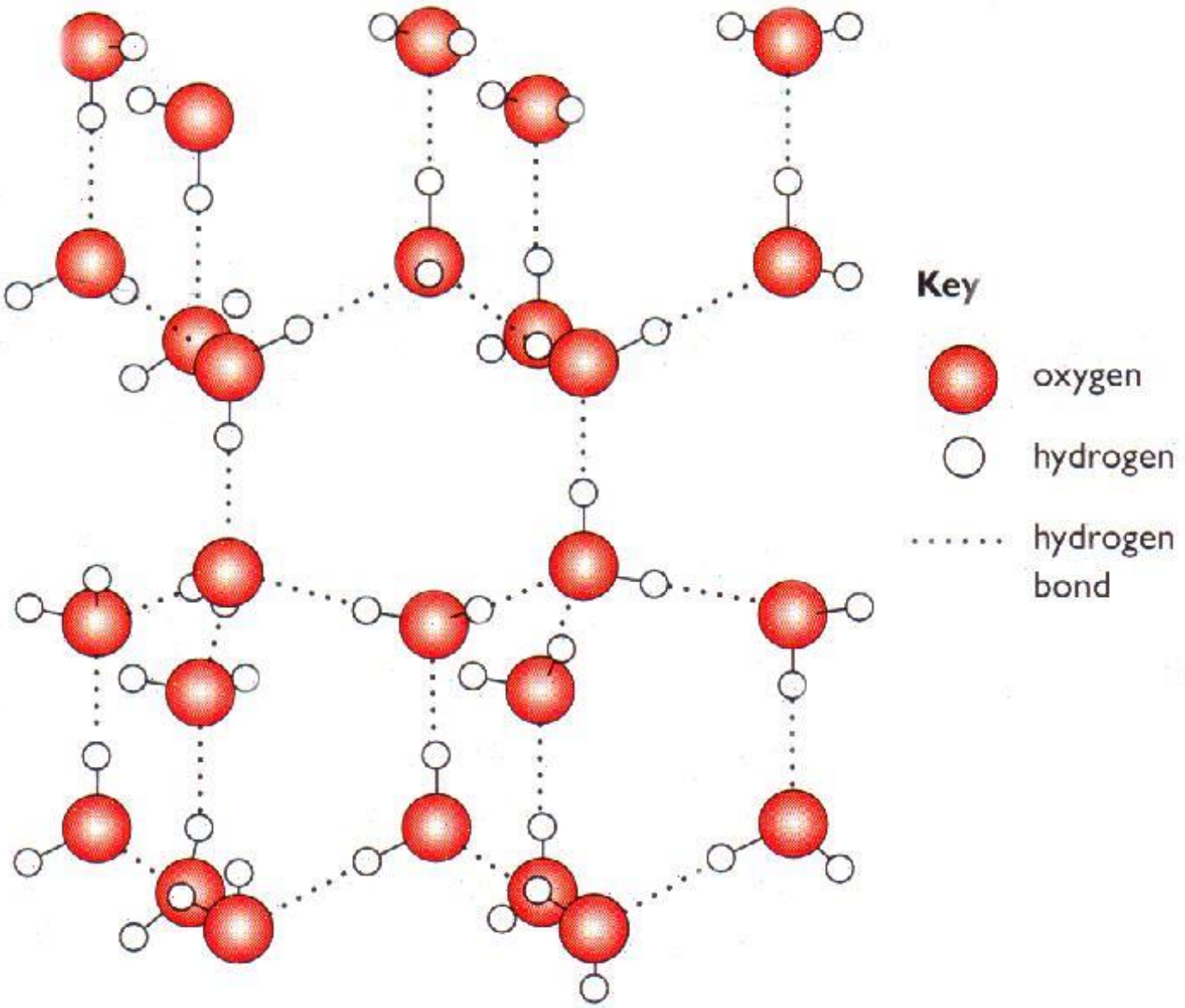


## LIQUID $I_2$

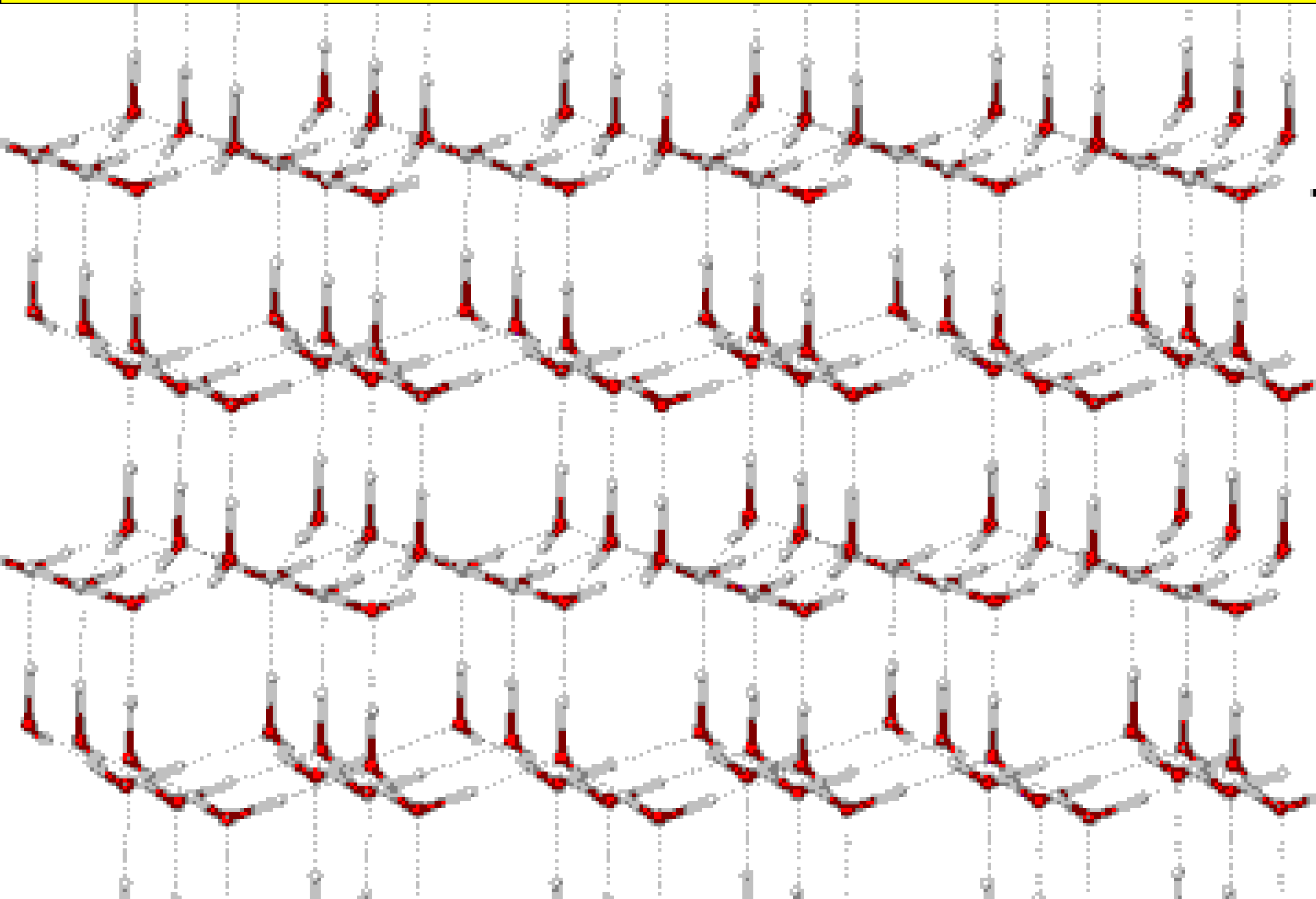


| | PROPERTY | EXPLANATION |
|---|---|---|
| Melting & boiling points | LOW | Weak forces between molecules |
| Electrical conductivity | DOES NOT CONDUCT | No mobile charged particles |
| Strength | BRITTLE | Weak forces between molecules |
| Solubility in water | SLIGHTLY SOLUBLE | |

# SIMPLE MOLECULAR e.g. ice

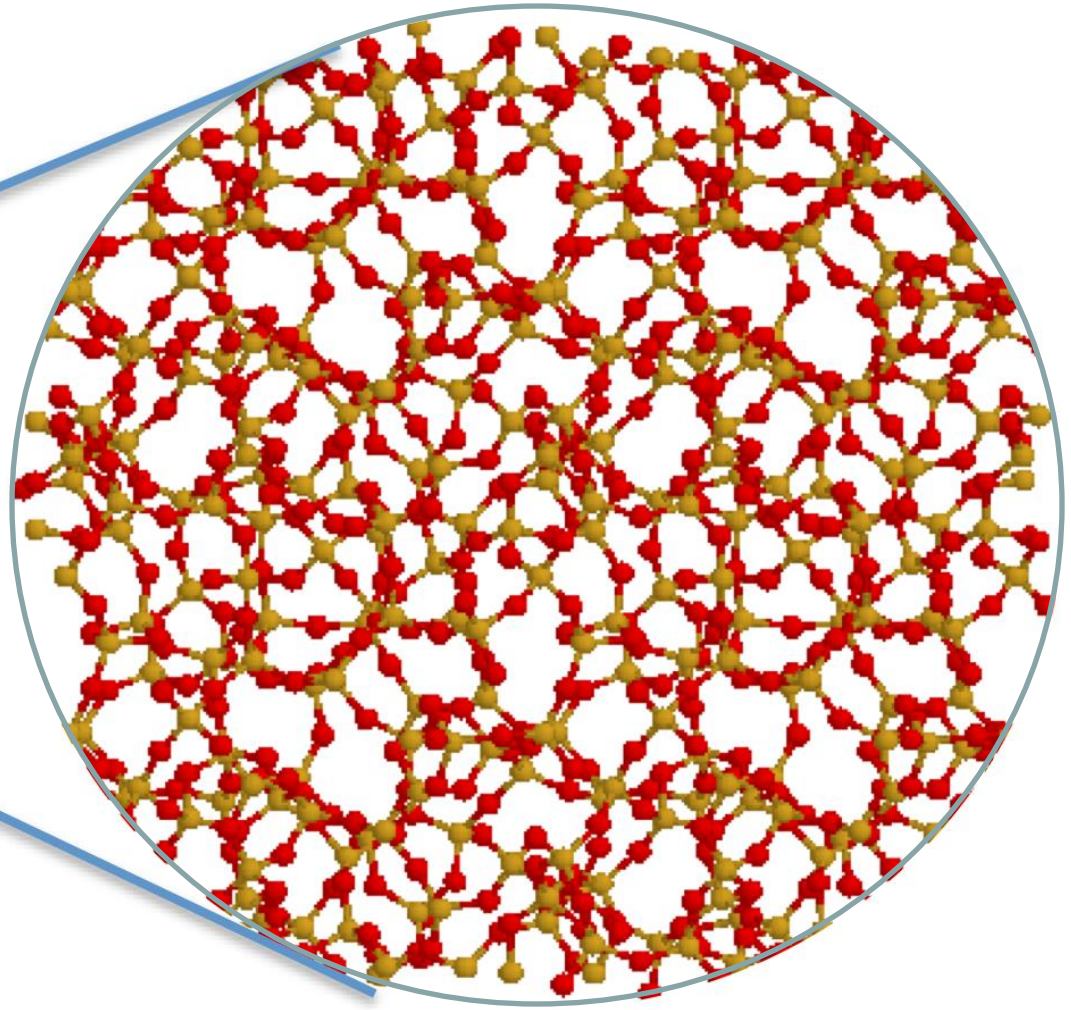


# SIMPLE MOLECULAR e.g. ice

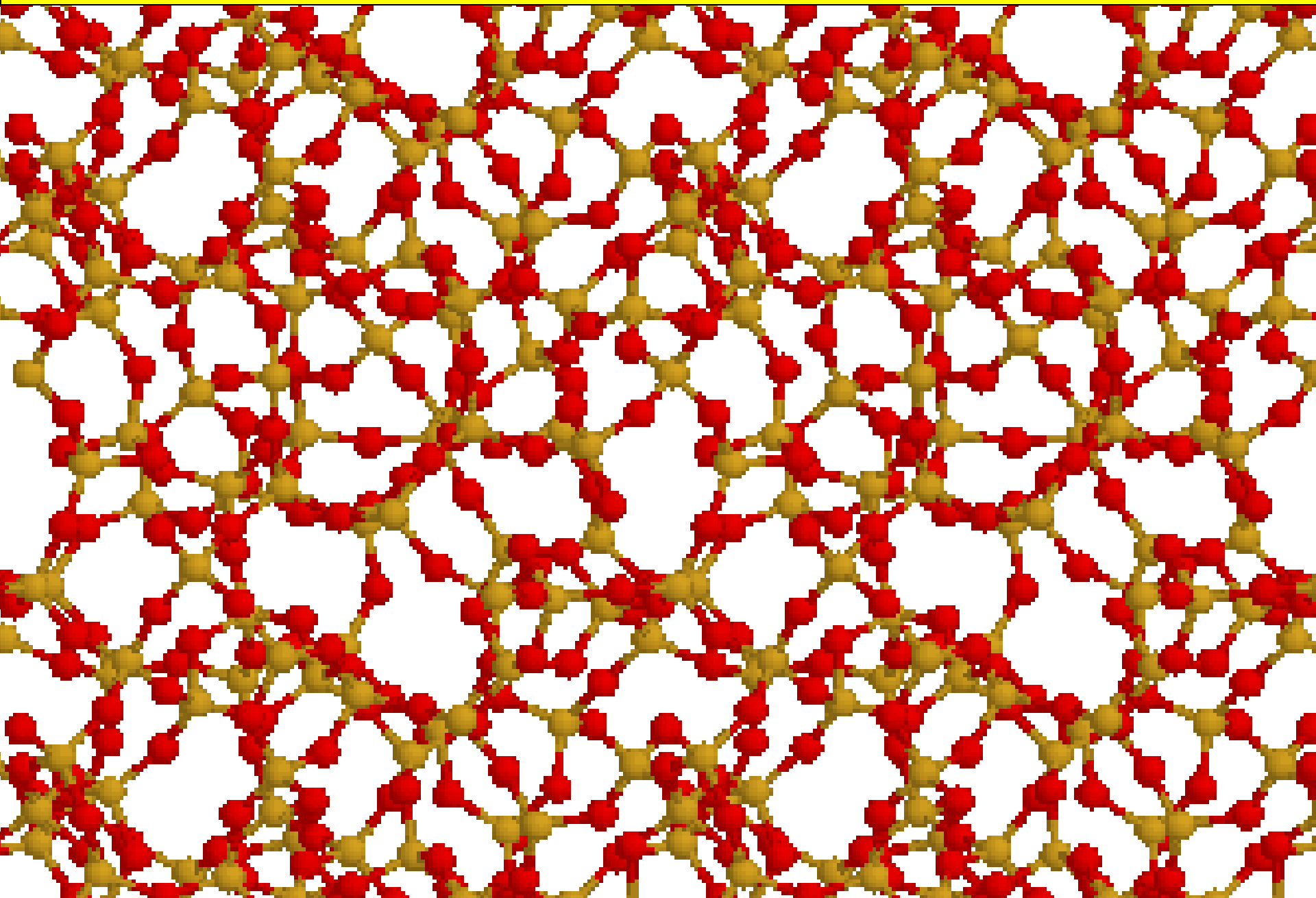


| | PROPERTY | EXPLANATION |
|---|---|---|
| Melting & boiling points | LOW | Weak forces between molecules |
| Electrical conductivity | DOES NOT CONDUCT | No mobile charged particles |
| Density of ice v water | ICE IS LESS DENSE THAN WATER | In ice molecules are arranged in lattice due to H-bonds; as a liquid molecules are closer as not in lattice |

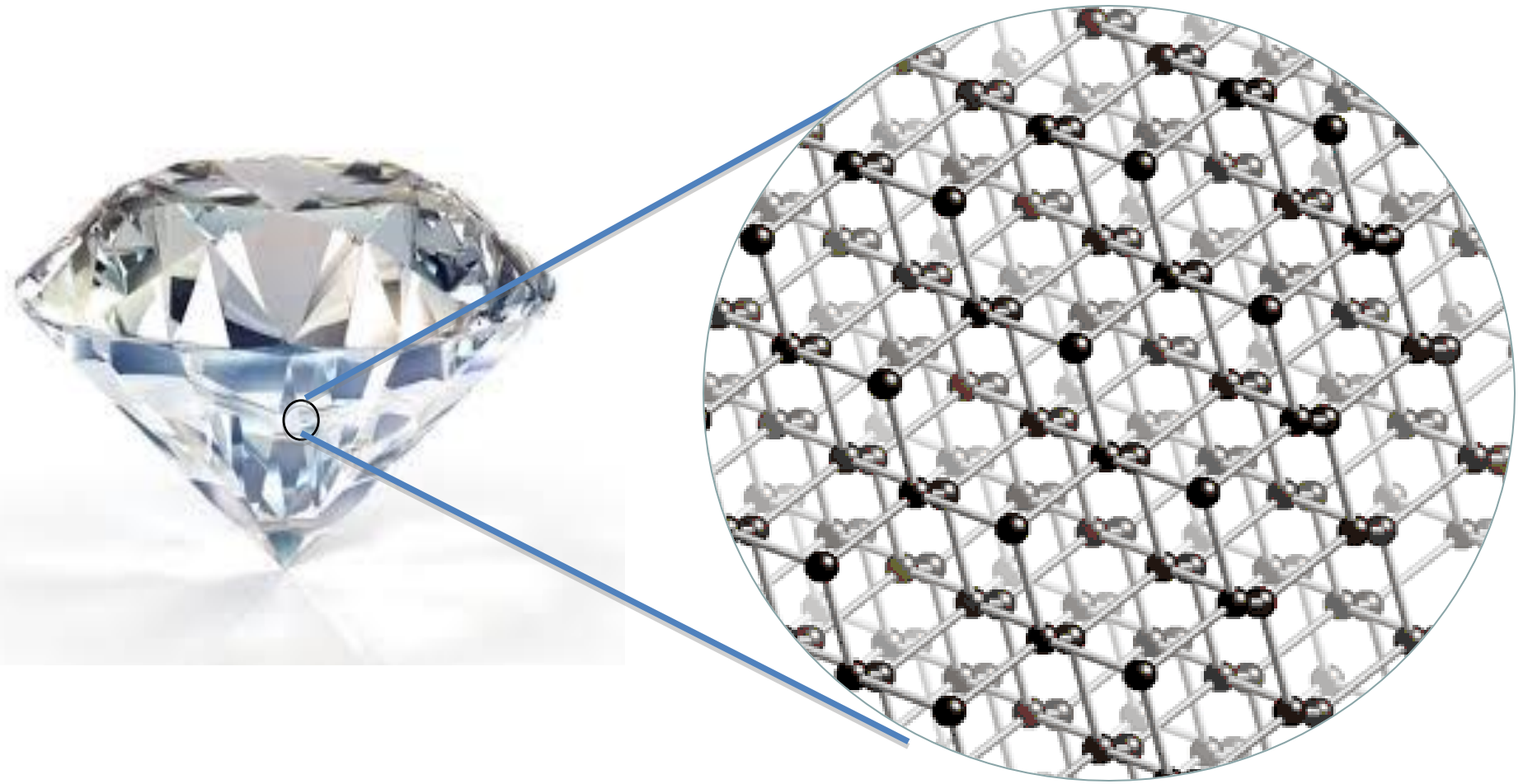
# GIANT COVALENT e.g. $SiO_2$



# GIANT COVALENT e.g. $SiO_2$

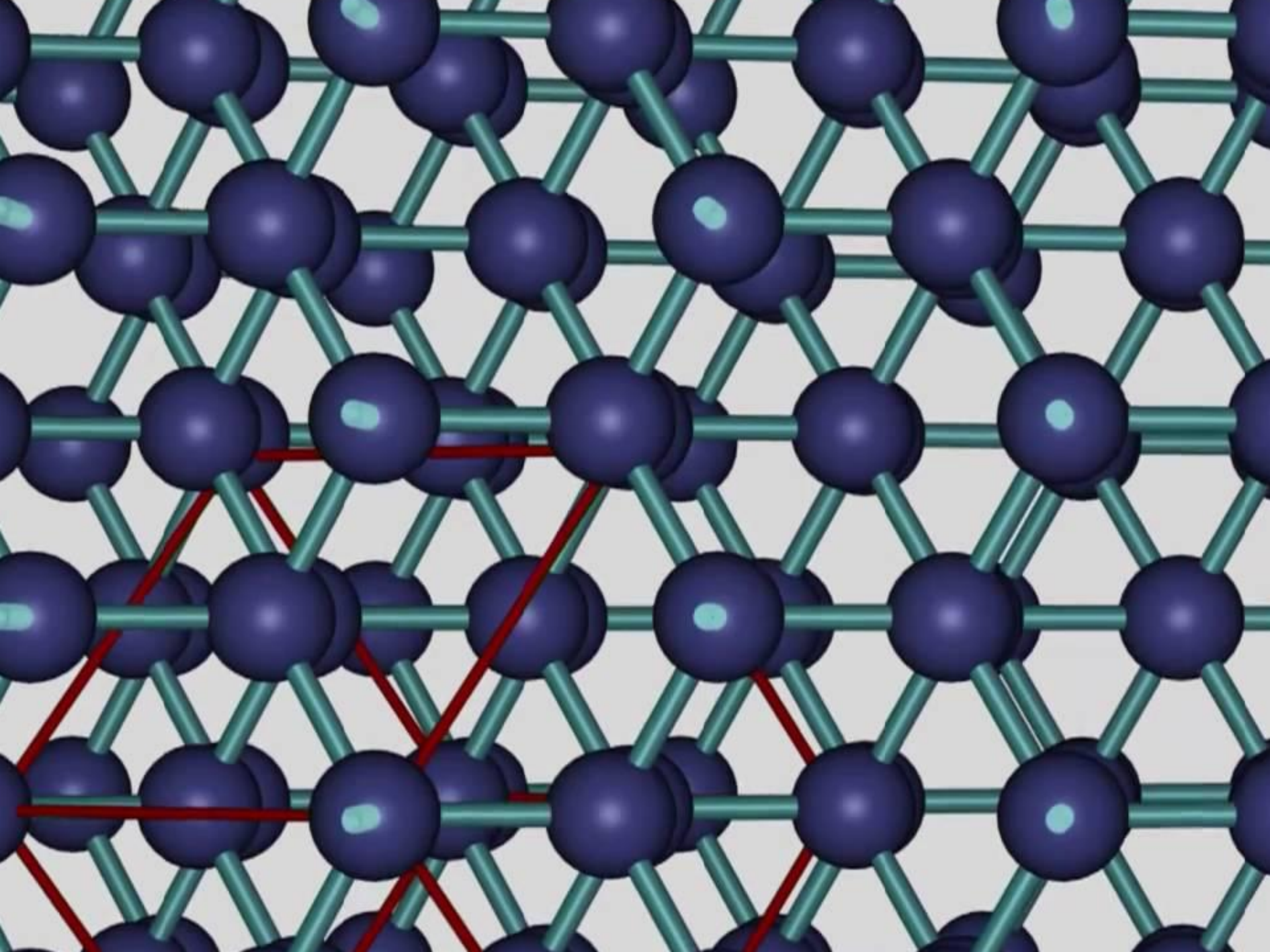


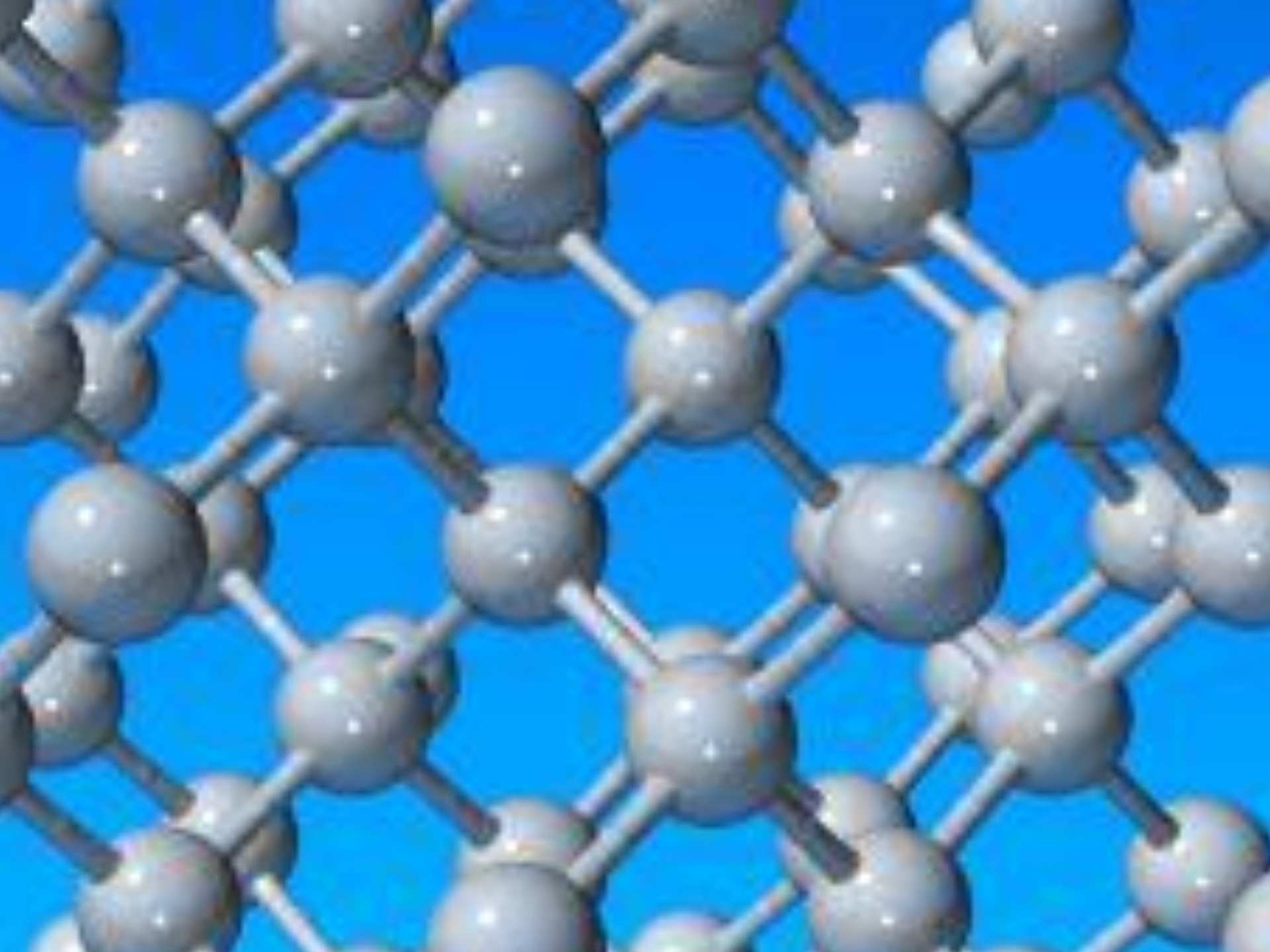
# GIANT COVALENT e.g. diamond



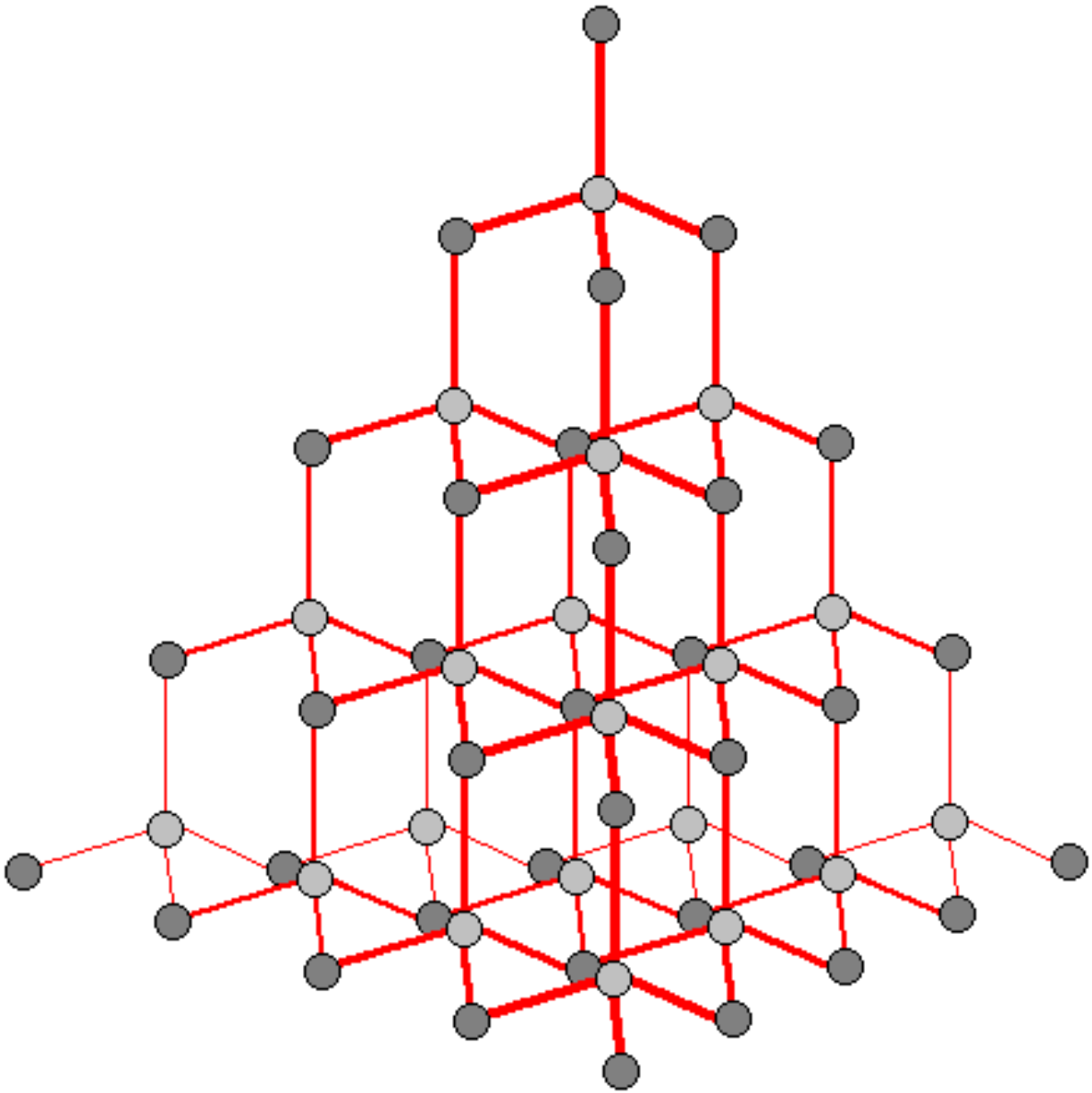
http://www.edinformatics.com/interactive_molecules/diamond.htm

Great rotatable structures (but they are NOT molecules!!)



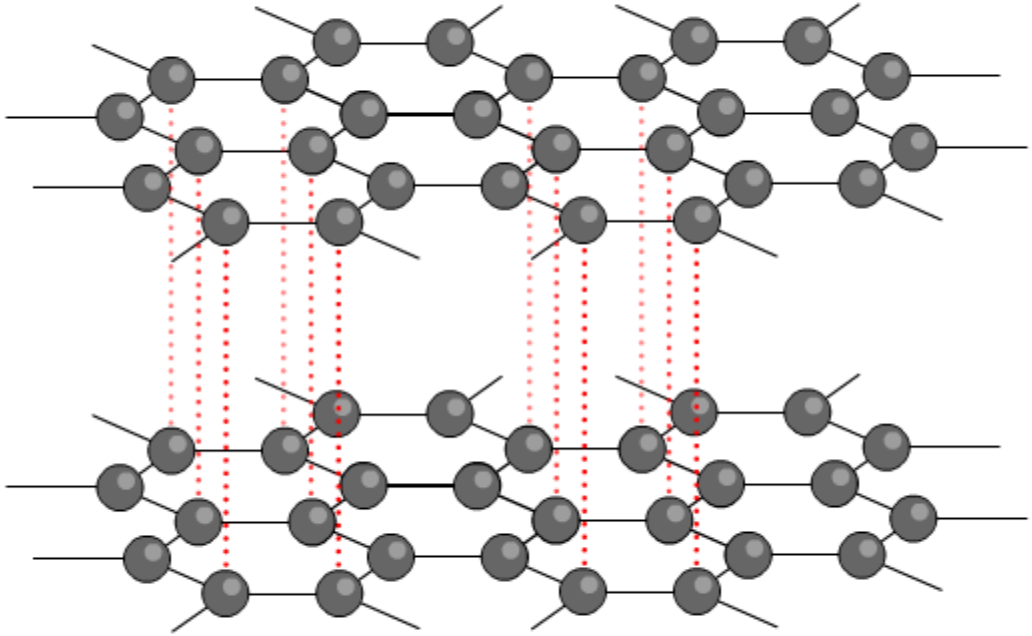


# GIANT COVALENT e.g. diamond



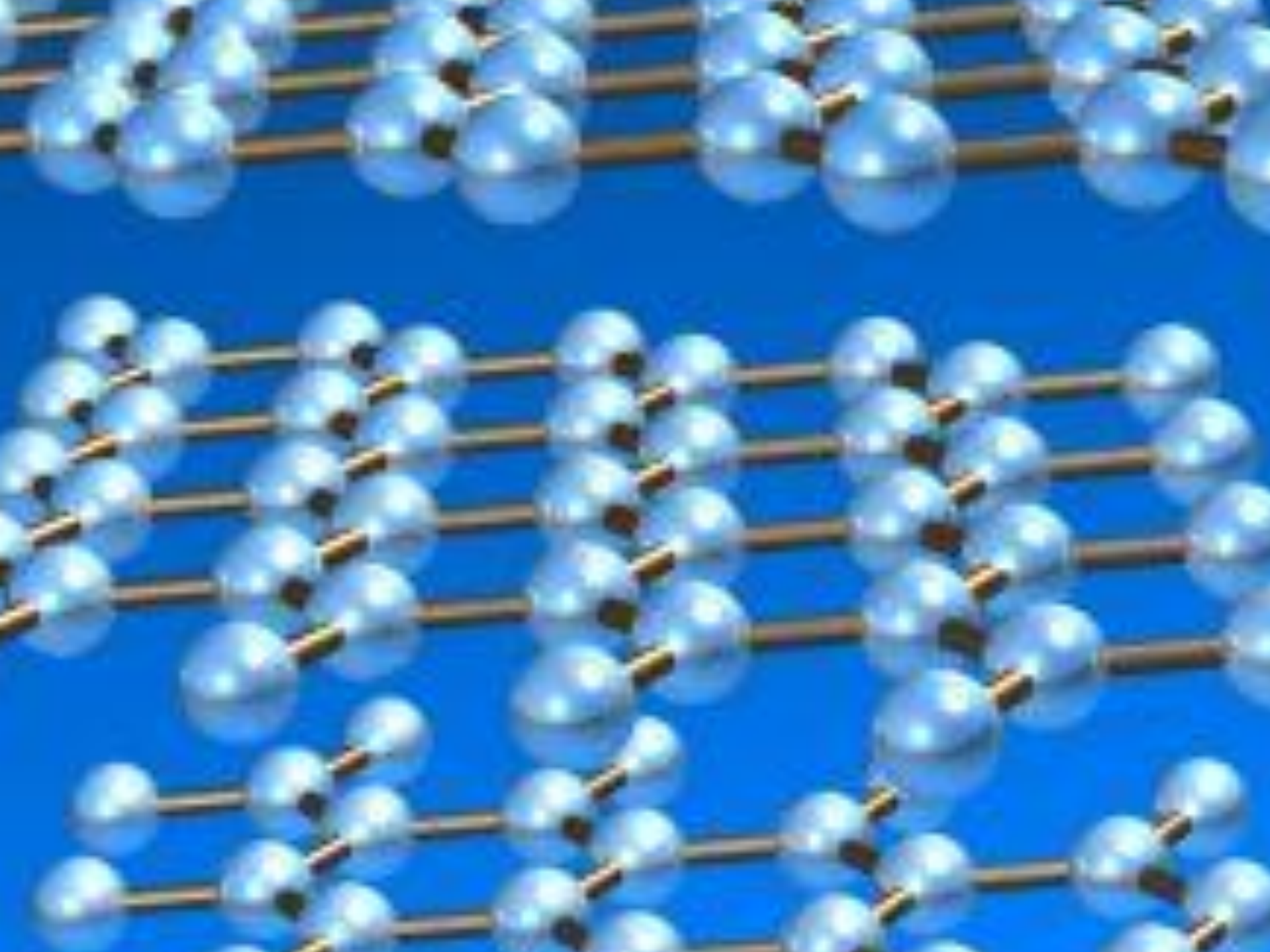
| | PROPERTY | EXPLANATION |
|---|---|---|
| Melting & boiling points | VERY HIGH | Need to break all strong covalent bonds |
| Electrical conductivity | DOES NOT CONDUCT | No mobile charged particles |
| Strength | STRONG | Rigid arrangement of atoms held by covalent bonds |
| Solubility in water | INSOLUBLE | |

# GIANT COVALENT e.g. graphite

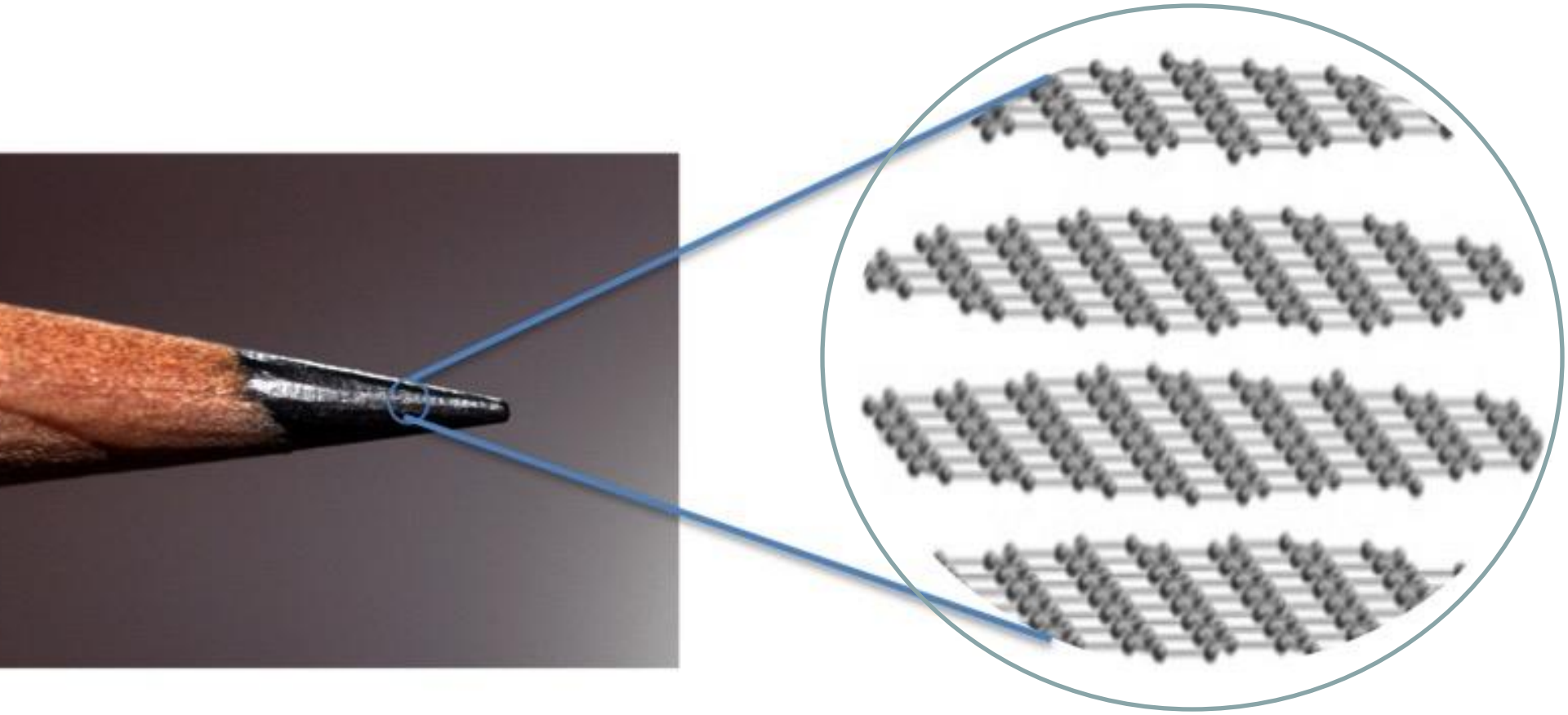


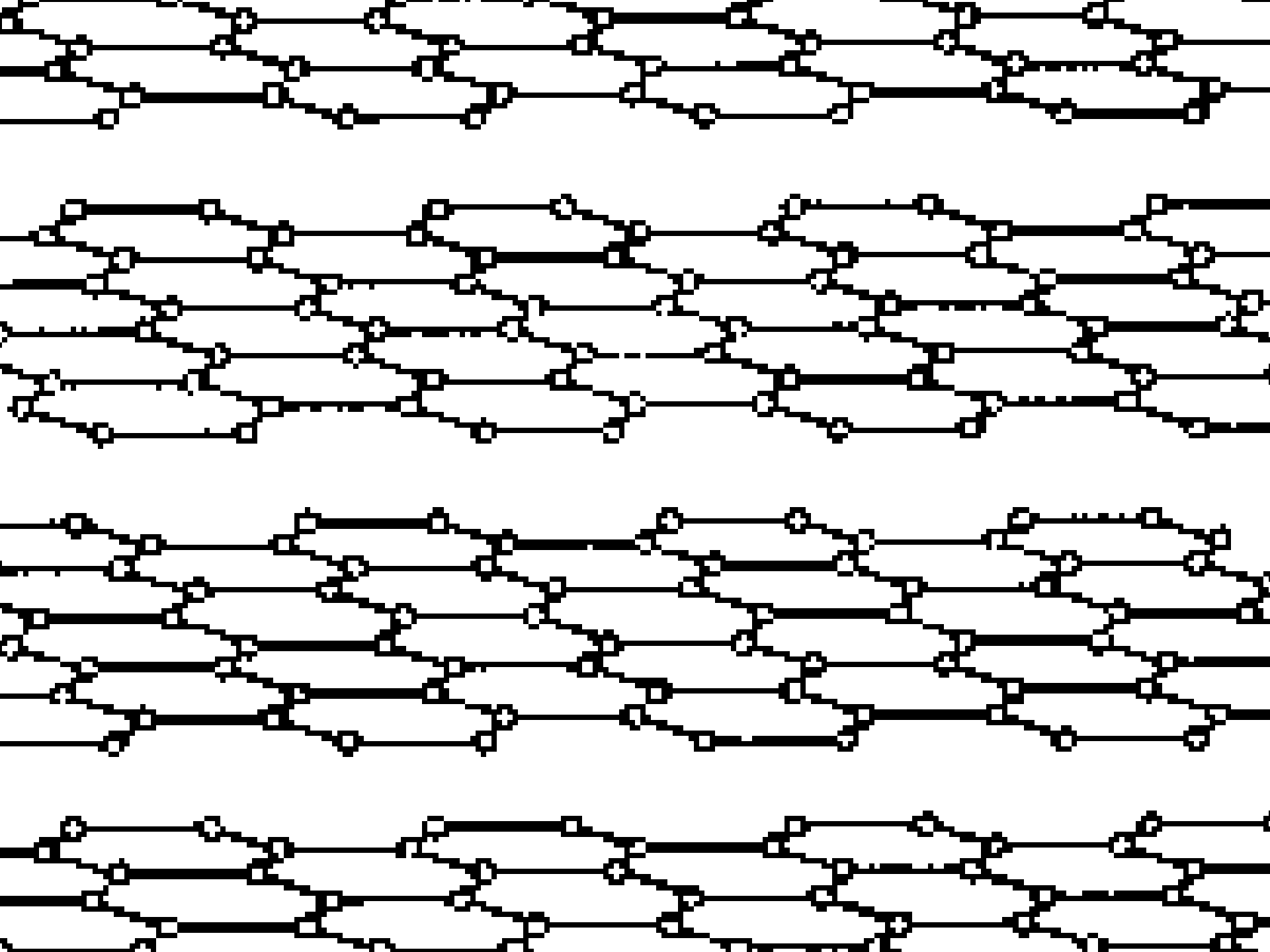
http://www.edinformatics.com/interactive_molecules/diamond.htm

Great rotatable structures (but they are NOT molecules!!)



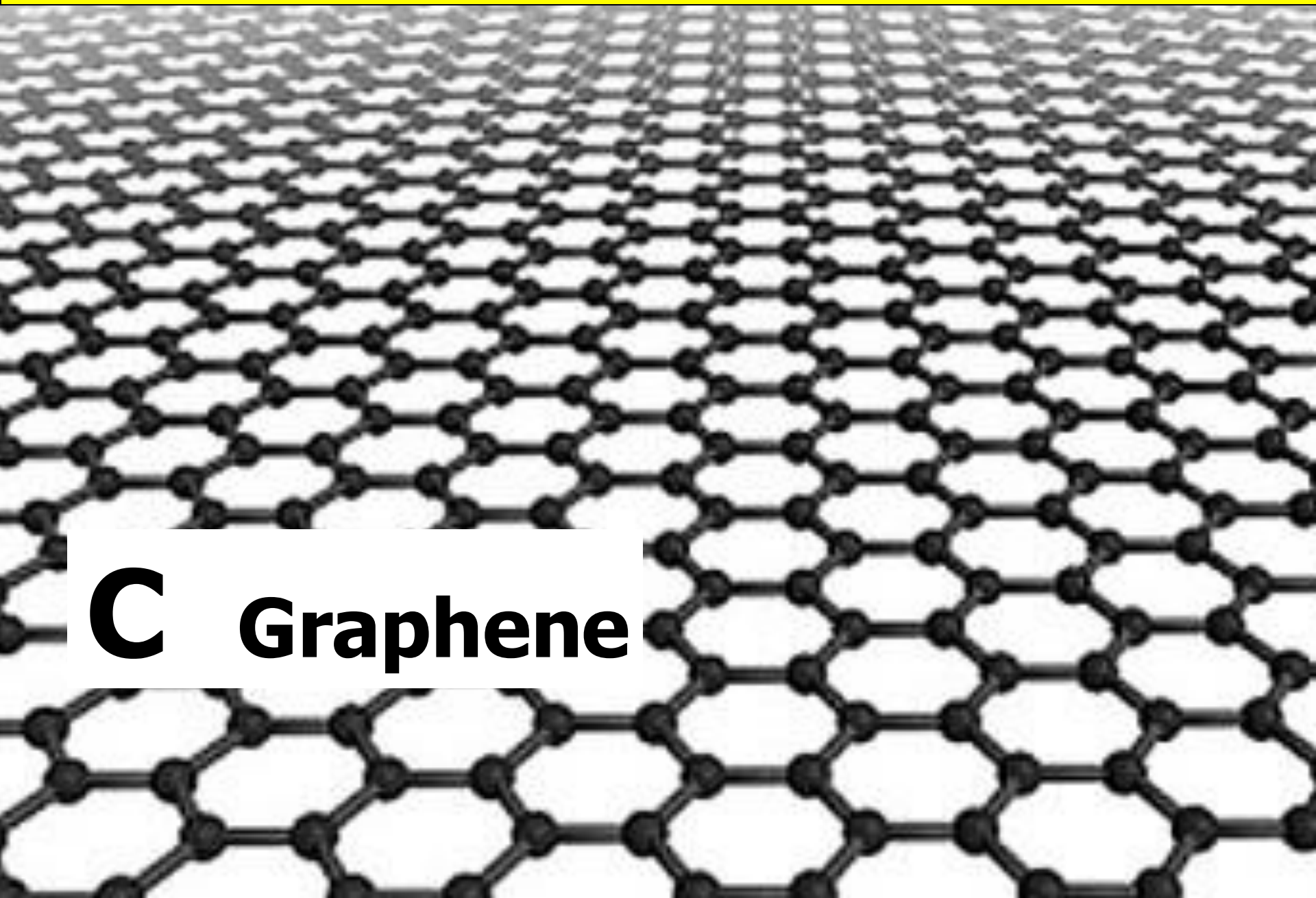
# GIANT COVALENT e.g. graphite



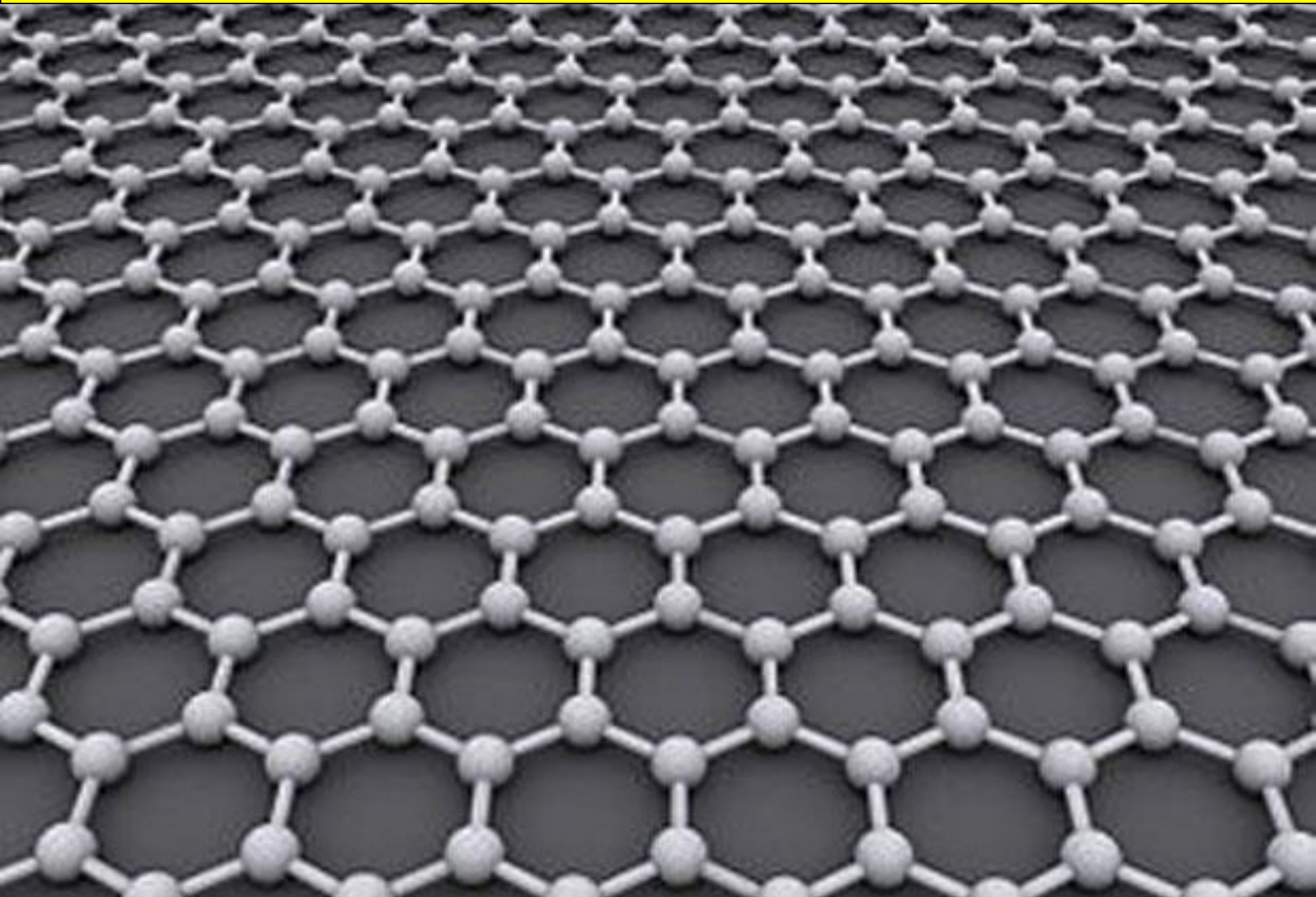


| | PROPERTY | EXPLANATION |
|---|---|---|
| Melting & boiling points | VERY HIGH | Need to break all strong covalent bonds |
| Electrical conductivity | CONDUCTS | Some electrons free to move between layers |
| Strength | BRITTLE | Weak forces between layers so layers can slide |
| Solubility in water | INSOLUBLE | |

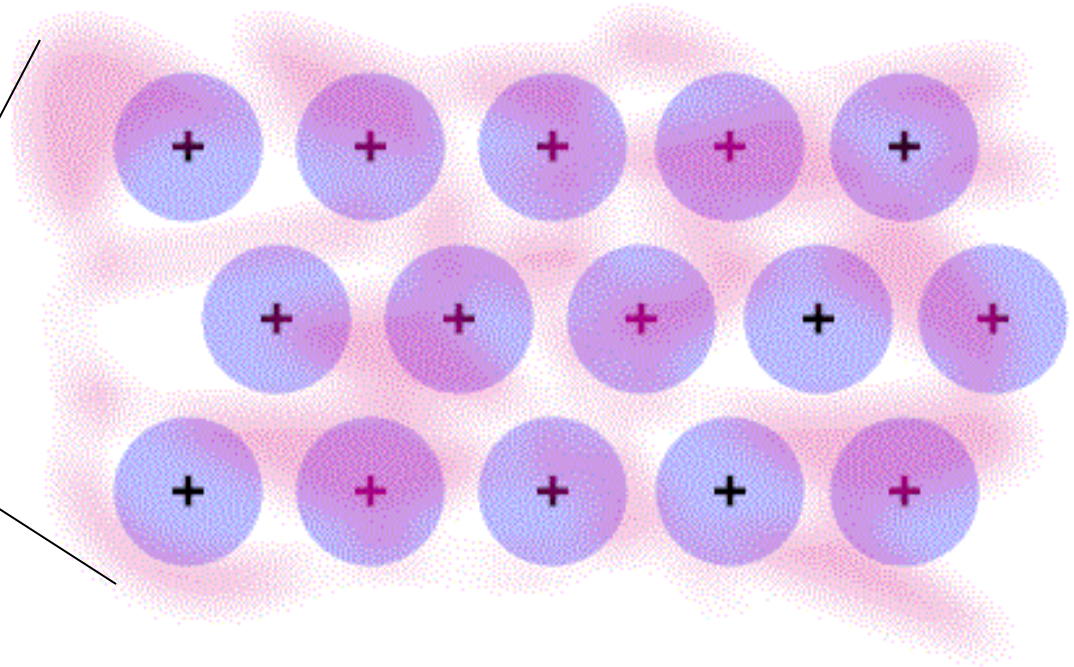
# GIANT COVALENT e.g. graphene

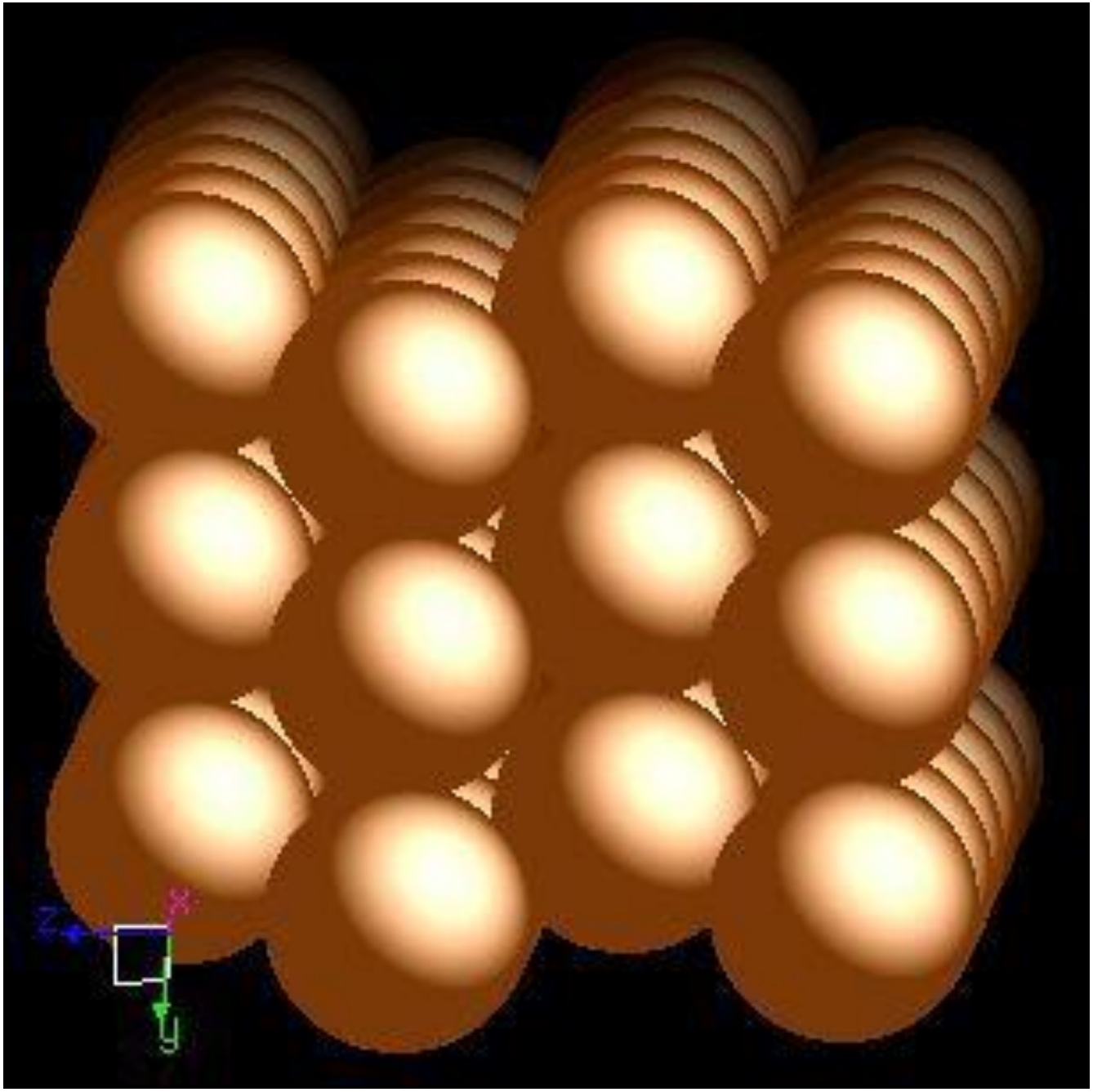


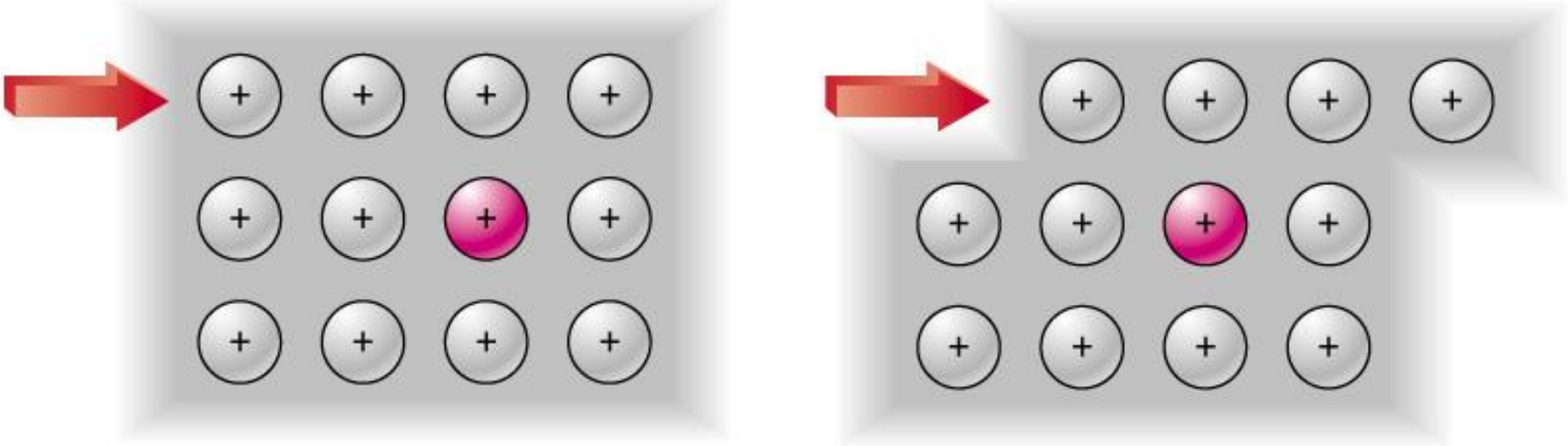
# GIANT COVALENT e.g. graphene



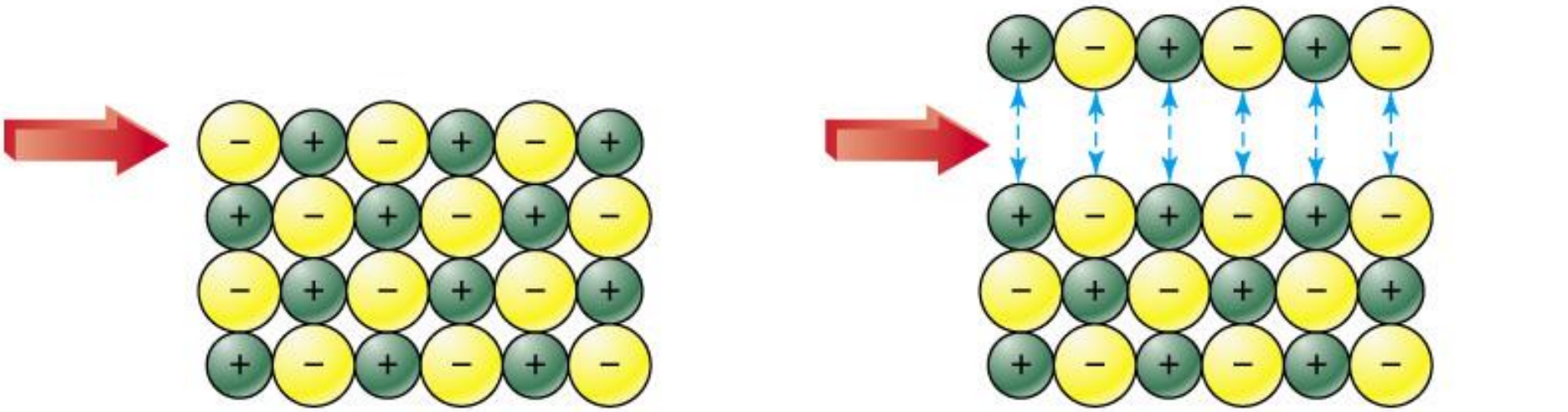
# METALLIC e.g. Mg


x
z
y



**(a)** Metal



**(b)** Ionic crystal

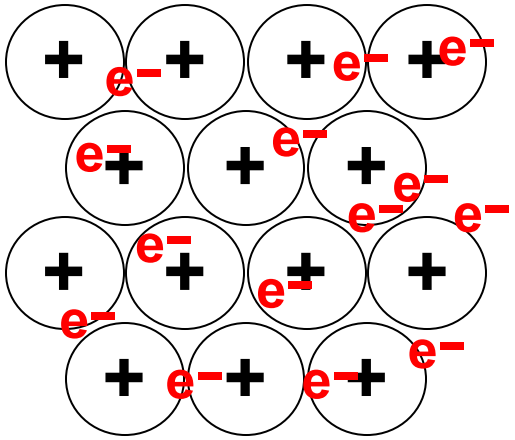
| | PROPERTY | EXPLANATION |
|---|---|---|
| Melting & boiling points | HIGH | Strong attraction between +ve ions and delocalised e-'s |
| Electrical conductivity | CONDUCTS | Outer shell electrons free to move |
| Strength | STRONG | Layers can slide while maintaining metallic bonding |
| Solubility in water | INSOLUBLE | |

Rank these metals in order of melting points:

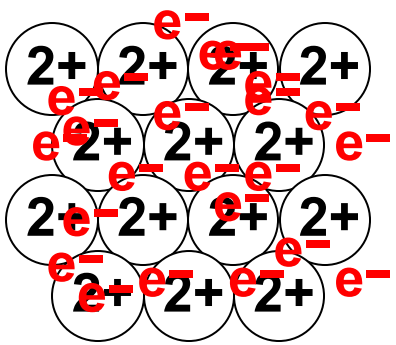
Sodium

Potassium

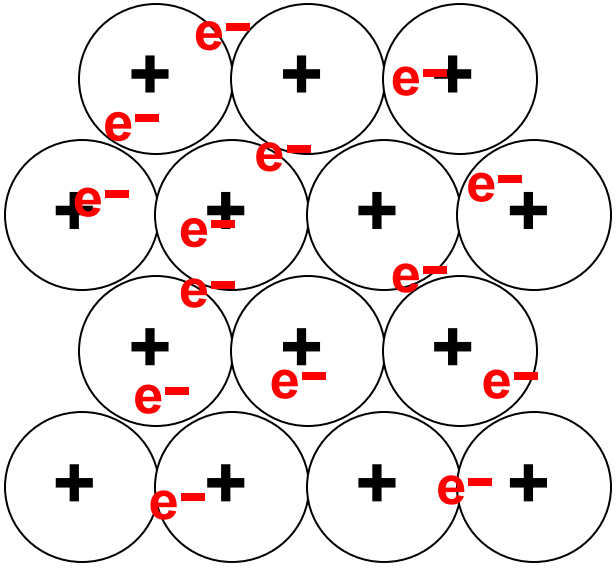
Magnesium



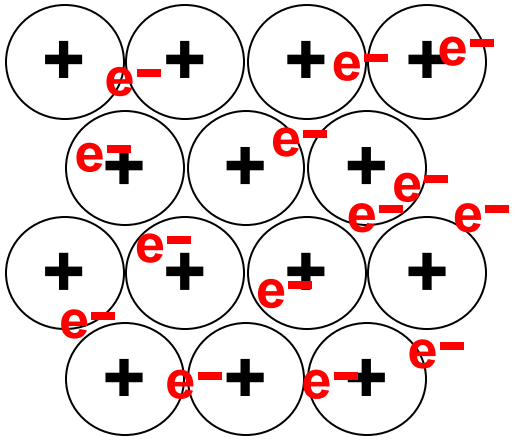
Sodium
(Na)



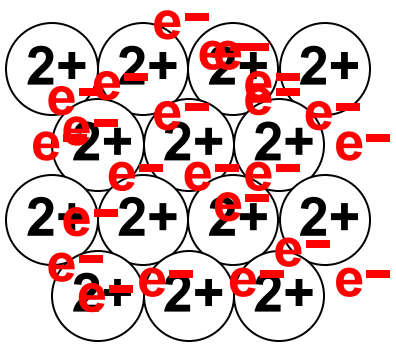
Magnesium
(Mg)



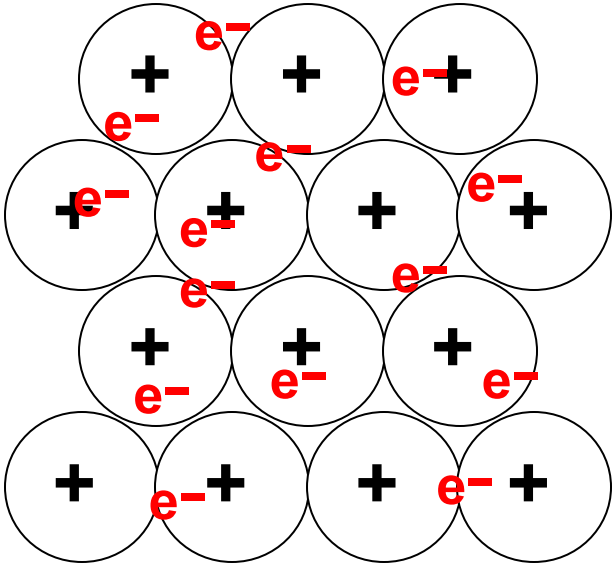
Potassium
(K)



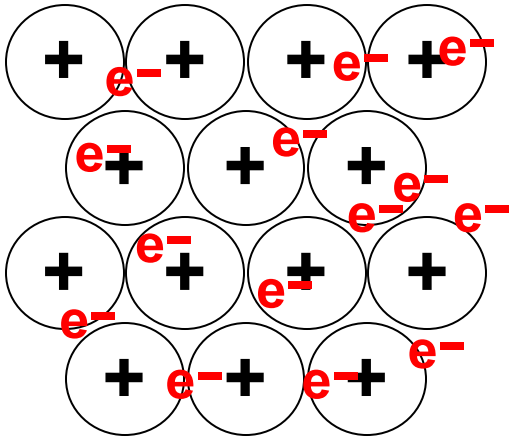
**Sodium**
**(Na)**
**Mpt 98ºC**



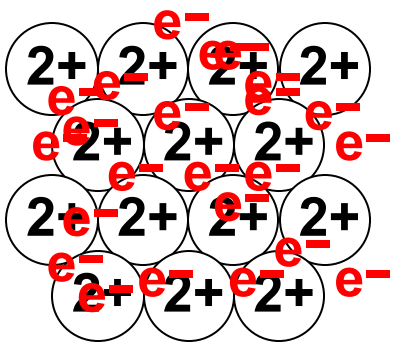
**Magnesium**
**(Mg)**
**Mpt 650ºC**



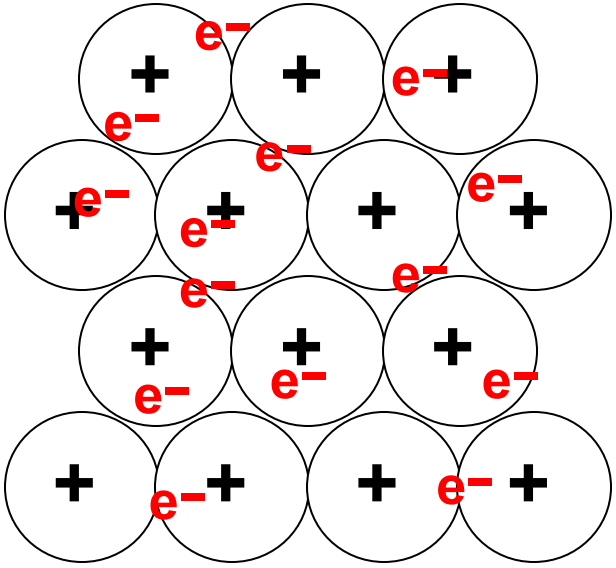
**Potassium**
**(K)**
**Mpt 64ºC**



**Sodium**
**(Na)**
**Mpt 98ºC**
**Con 0.218**



**Magnesium**
**(Mg)**
**Mpt 650ºC**
**Con 0.224**



**Potassium**
**(K)**
**Mpt 64ºC**
**Con 0.143**

**Con = Electrical conductivity**
**(measured as $10^{-8}\ \Omega^{-1}m^{-1}$)**