

Bond Type and Properties

PROPERTY	IONIC	MOLECULAR COVALENT	GIANT COVALENT	METALLIC
Melting Point, Boiling Point, Latent Heat of Fusion	High - ∴ each +ion is attracted to many -ions and vice-versa. Attraction is hard to break and is spread throughout crystal.	Low - ∴ there is little attraction between the individual molecules (v-d-W, d-d, h-b), and they can be easily separated.	High - each atom is attracted to others by covalent bonds right throughout the crystal- to melt solid, to break all bonds.	High -each atom is held in place by 12 others by metallic bond right through crystal, ∴ must break bonds to melt solid.
Solubility in Water	Usually good - as water is an insulator and can reduce the attraction of the ions for each other, hydration of ions($H_e > L_e$)	Varies - molecules easily separated from each other, so may dissolve in water or other solvents.	Insoluble - as it would be necessary to break the covalent bonds which would require much energy.	Insoluble - too difficult to break metallic bonds and separate the atoms.
Conductivity: Solid	Poor - as the ions are fixed in position by electrostatic attraction and can not move.	Poor - as the only charged particles (the electrons)are held tight to their own atoms and can not move.	Poor - see molecular covalent	Good - as the electrons in the sea of delocalised electron cloud can move easily from atom to atom.
Conductivity: Molten (liquid)	Good - as the ions are now free to move and (as they are charged) so they can carry the current.	Poor - the same reason as the solid.	Poor - the same reason as the solid.	Good - the electrons can still move freely.
Conductivity: In Solution in water, (aq)	Good - the same reason as liquid.	Poor - the same reason as the solid.	Insoluble	Insoluble

Note:

All atoms, and therefore all elements and compounds, contain protons and electrons, which are both charged.

The protons are always fixed in position in the nucleus and cannot move.

The electrons are held firmly on the atom, ion or in the compound and cannot move **except** in metals.

The particles which carry the charge in ionic substances are the **ions**.

Acids are a special case of molecular covalent. Their properties are the same as other molecular covalent - **except** that they conduct electricity when they are dissolved in water, because they react with the water forming ions - i.e. they ionise.