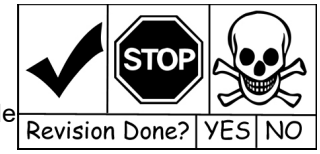
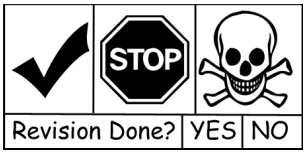
Unit 3 Bonding (Paper 1, 2 & 3)

3.1 Types of Bonding

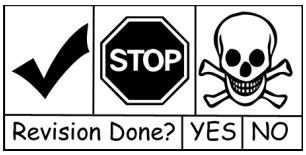
Ionic Bonding
Ionic bonding involves electrostatic attraction between oppositely charged ions in a lattice.
The formulas of compound ions eg sulphate, hydroxide, nitrate, carbonate and ammonium.
You should be able to:
• predict the charge on a simple ion using the position of the element in the Periodic Table
• construct formulas for ionic compounds.



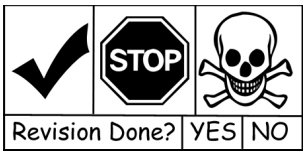
Nature of covalent and dative covalent bonds
A single covalent bond contains a shared pair of electrons.
Multiple bonds contain multiple pairs of electrons.
A co-ordinate (dative covalent) bond contains a shared pair of electrons with both electrons supplied by one atom.
You should be able to represent:
• a covalent bond using a line
• a co-ordinate bond using an arrow.



Metallic Bonding
Metallic bonding involves attraction between delocalised electrons and positive ions arranged in a lattice.
You should be able to:
• explain the properties if metals using appropriate detail derived from the structure of metal crystals.

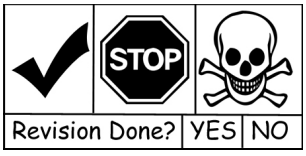


Bonding and Physical Properties
The four types of crystal structure:
• ionic
• metallic
• macromolecular (giant covalent)
• molecular.
The structures of the following crystals as examples of these four types of structure:
• diamond
• graphite
• ice
• iodine
• magnesium
• sodium chloride.
You should be able to:
• relate the melting point and conductivity of materials to the type of structure and the bonding present
• explain the energy changes associated with changes of state
• draw diagrams to represent these structures involving specified numbers of particles.



3.2 Shapes

Shapes of simple molecules and ions
Bonding pairs and lone (non-bonding) pairs of electrons as charge clouds that repel each other.
Pairs of electrons in the outer shell of atoms arrange themselves as far apart as possible to minimise repulsion.
Lone pair–lone pair repulsion is greater than lone pair–bond pair repulsion, which is greater than bond pair–bond pair repulsion.
The effect of electron pair repulsion on bond angles.
You should be able to explain the shapes of, and bond angles in, simple molecules and ions with up to six electron pairs (including lone pairs of electrons) surrounding the central atom.



3.3 Polarity and IMF

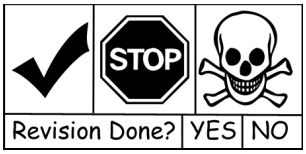
Bond Polarity

Electronegativity as the power of an atom to attract the pair of electrons in a covalent bond.

The electron distribution in a covalent bond between elements with different electronegativities will be unsymmetrical. This produces a polar covalent bond, and may cause a molecule to have a permanent dipole.

You should be able to:

- use partial charges to show that a bond is polar
- explain why some molecules with polar bonds do not have a permanent dipole.



Forces acting between molecules

Forces between molecules:

- permanent dipole–dipole forces
- induced dipole–dipole (van der Waals, dispersion, London) forces
- hydrogen bonding.

The melting and boiling points of molecular substances are influenced by the strength of these intermolecular forces.

The importance of hydrogen bonding in the low density of ice and the anomalous boiling points of compounds.

You should be able to:

- explain the existence of these forces between familiar and unfamiliar molecules
- explain how melting and boiling points are influenced by these intermolecular forces.