Bonding and physical properties

turning a solid to liquid (fusion)

* When heating, a solid or supplying energy, it vibrates to a more fixed position therefore increasing the distance between particles so it expands
* Supplying more energy can turn a solid into a liquid – this is required to weaken the forces that act between the particles
* Energy known as the **enthalpy change of melting**
* When a solid is melting, the temperature does not change as the heat is absorbed as the forces are weakened

Enthalpy = the heat energy change measured under constant pressure

Temperature depends on the average kinetic energy which is also related to their speed

Turning a liquid to a gas (vaporisation)

* Particles move further apart after being supplied energy therefore liquids also expand when heated
* Energy is required to break all the intermolecular forces between the particles
* Energy known as **enthalpy change of vaporisation**
* No temperature change during the process of boiling
* Gases expand a great deal when heated because they also gain kinetic energy and move further apart

Crystals

* Have a regular arrangement and are held together by forces of attraction
* The strength of forces of attraction has an effect on the physical properties of crystals
* Stronger the force, the higher the melting point/temperature and a greater the enthalpy

Molecular crystals – consist of molecules held in a regular structure by intermolecular forces and molecules held together by covalent bonds however are much weaker so have a low melting temperature and low enthalpy

Properties

* Crystals are soft and break easily
* Low melting point temperature
* Does not conduct electricity because there are no charged particles

Diamond (macromolecular crystal)

* Polymorph or allotrope of carbon
* Consists of pure carbon with covalent bonding between every carbon atom
* Giant structure – bond spreads throughout the structure
* Each carbon forms four single covalent bonds with other carbon atoms
* These four electrons repel from each other – **electron pair repulsion theory**
* Bond angles of 109.5°

Properties of diamond

* Very hard material
* Very high melting temperature (over 3,700k)
* Does not conduct electricity because there are no delocalised electrons to carry the charge

Graphite

* Consists of pure carbon atoms which are bonded and arranged differently
* Strong covalent and weak van der Waals forces
* Bond at angle 120°
* Leaves each carbon atom with a spare electron in a p-orbital that is not part of the three single covalent bonds
* Electrons are able to move anywhere within the layer (delocalised)
* Weak intermolecular forces allows layers to slide across one another

Properties of graphite

* graphite is a soft material
* very high melting temperature – breaks down before it melts due to strong network of covalent bonds
* conducts electricity

Electrical conductivity

* ionic compound conduct electricity only in liquid state
* current is carried by the movement of ions towards the electrodes of opposite charge
* covalent bonded substances do not conduct electricity as they have no charged particles which are able to carry a current
* mostly insoluble in water and can react to form ions ex. Ethanoic acid

Melting and boiling points

* simple molecules – low melting and boiling points
* giant structured molecules – high melting and boiling points

Intermolecular forces

* strength of force determines melting and boiling points