**Structure and Bonding Summary** **– Metallic & Ionic**

**Structure** – the arrangement of the atoms

**Bonding** – how the atoms held together

**Changing state** - amount of energy needed to change state depends on strength of forces between particles in a substance - the stronger the forces the higher the melting point and boiling point of the substance

| **Type** | **Structure** | **Bonding** | **Property** | **Reason** |
| --- | --- | --- | --- | --- |
| **Metallic**  Metals (including alloys)  Electrons in the outer shell of metal atoms are delocalised and  so are free to move through the whole structure leaving the atoms with a positive charge | Giant metallic lattice | Strong electrostatic force between delocalised electrons and positive ions | **High** melting and boiling points | Strong electrostatic force between delocalised electrons and positive ions |
| **Malleable** and **ductile** (can be bent and made into wires) | Layers of atoms able to slide over each other |
| Pure metals are too soft so are mixed with other metals to make alloys which are harder | Larger atoms of other metal disrupt the layers and prevent them form sliding over each other |
| **Good** conductors of **electricity** | Delocalised electrons carry electrical charge through the metal |
| **Good** conductors of **heat** | Thermal energy is  transferred by delocalised electrons |
| **Ionic**  Metal & non-metals  Metal atoms lose  electrons to become positively charged ions  Non-metal atoms gain  electrons to become negatively charged ions | Giant ionic lattice | Strong electrostatic forces of attraction between oppositely charged ions | **Solids** with **high** melting and **high** boiling points | Strong electrostatic forces of attraction between oppositely charged ions  Large amounts of energy needed to break the many strong bonds |
| **Do conduct** **electricity** when melted (**molten**) or dissolved in water (**solution**)  **Do not conduct** **electricity** when **solid** | Ions are free to move and carry the charge  Ions are not free to move |