**Structure and Bonding Summary – Covalent**

**Structure** – the arrangement of the atoms

**Bonding** – how the atoms are 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** |
| --- | --- | --- | --- | --- |
| **Small molecules**  Non-metals  Atoms share pairs of electrons | Small molecules or molecular | Shared pairs of electrons form strong covalent bonds  Weak forces between molecules  Intermolecular forces  are weak compared with covalent bonds | **Gases** or **liquids** with **low** melting and boiling points  Larger molecules have higher melting and boiling points | Weak intermolecular forces are broken (not the strong covalent bonds)  The intermolecular forces increase with the size of the molecules |
| **Do not conduct** **electricity** | Do not have an overall electric charge |
| **Giant molecules**  Non-metals  Atoms share pairs of electrons | Giant covalent  structures or macromolecular | Shared pairs of electrons form strong covalent bonds between **all** atoms |  |  |
|  |  |  |  |  |
| **Diamond** | Tetrahedral | Each carbon atom forms **four** covalent bonds with other carbon atoms | **Very high** melting point | All atoms are bonded to other atoms by strong covalent bonds which must be broken to melt |
| **Very** **hard** | All atoms are bonded to other atoms by strong covalent bonds which must be broken to melt |
| **Does not conduct** **electricity** | Do not have an overall electric charge |
| **Graphite** | Layers of hexagonal rings with no covalent bonds between the layers    Layers held by weak forces | Each carbon atom forms **three** covalent bonds with three other carbon atoms  **One** electron from each carbon atom is **delocalised** and able to move along the layers | **Very high** melting point | All atoms are bonded to other atoms by strong covalent bonds which must be broken to melt |
| **Soft** and slippery | Weak forces between layers are easily broken |
| **Does conduct** **electricity** | Delocalised electrons carry electrical charge along the layers |