1 – Covalent Bonding	
Covalent Bond	Bond formed between two **non-metal atoms** when they **share** a **pair** of **electrons**.
Double Covalent Bond	Bond formed between two **non-metal atoms** when they **share two pairs** of **electrons**.
Electrostatic Attraction	Between the **negative shared electrons** and the **positive nuclei** of the atoms.
2 – Simple Molecular Covalent Substances	
Structure	**Small molecules** made up of atoms **covalently bonded** together. **Weak intermolecular forces** between molecules. E.g. methane (**CH_4**), ammonia (**NH_3**).
Melting & Boiling Points	**Low** -> **intermolecular forces** are **weak** -> do **not** require much **energy** to break.
Size of Molecule	**Larger** molecules -> **stronger** intermolecular forces -> **higher** melting and boiling point.
Conductivity	Do **not conduct** -> no **charged particles**.
3 – Polymers Covalent Substances	
Structure	**Long chain molecules** made up of **repeating units** called **monomers**. **Intermolecular forces** between molecules. E.g. poly(ethene)
Melting & Boiling Points	**Higher** than simple molecular covalent as **larger molecules**. But **lower** than ionic and giant covalent.
Conductivity	Do **not conduct** -> no **charged particles**.
4 – Giant Covalent Substances	
Structure	**Giant molecule** made up of **very many atoms** all bonded to each other by **strong covalent bonds**. E.g. diamond, graphite and silicon dioxide (SiO_2).
Melting & Boiling Points	**High** -> many **strong** covalent bonds -> require a lot of **energy** to break.
Conductivity	Do **not conduct** -> no **charged particles** (except **graphite**).

5 – Allotropes of Carbon (contain covalent bonds)	
Diamond	Each carbon **bonded** to **4** others. Very **hard**. Very **high** melting point. Does **not conduct**. Uses -> **cutting** and **drills**.
Graphite	Each carbon **bonded** to **3** others. **Sheets** of atoms arranged in **hexagons**. **Weak** forces between sheets -> can **slide** over each other. **Conducts electricity** -> free **electrons**. Uses -> **lubricants** and **pencil lead.**
Graphene	**Single** sheet of **graphite**. Very **light** and **conducts electricity**. Uses -> **strengthening materials** and **electronics**.
Fullerenes	Molecules of carbon shaped like **tubes** or **balls**. E.g. Buckminsterfullerene = C_{60}. Uses -> l**ubricants**, **electronics**, **catalysts** and **strengthening**.
6 – Metallic Bonding	
Structure	**Lattice** of **positively charged metals ions** surrounded by a **sea** of **delocalised electrons**. Held together by **strong electrostatic forces**.
Melting & Boiling Points	**High** -> many **strong** electrostatic forces -> require a lot of **energy** to break.
Electrical Conductivity	**Conduct electricity** -> **free electrons** can move through **whole structure** -> carry **charge**.
Thermal Conductivity	**Conduct heat** -> **free electrons** can move through **whole structure** -> carry **thermal energy**.
Malleability	Can be **bent** or **hammered** into shape -> **layers** of atoms can **slide** over each other.
Alloys	**Mixture** of **metals** or a **mixture** of a **metal** and a **non-metal.**
Strength of Alloys	Different **sized** atoms -> **distorts layers** so they **cannot slide** over each other -> **stronger** than **pure** metal.

GCSE Science

Chemistry C2 – Covalent & Metallic Bonding