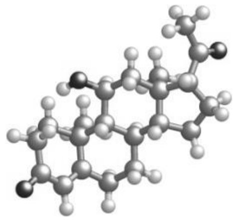

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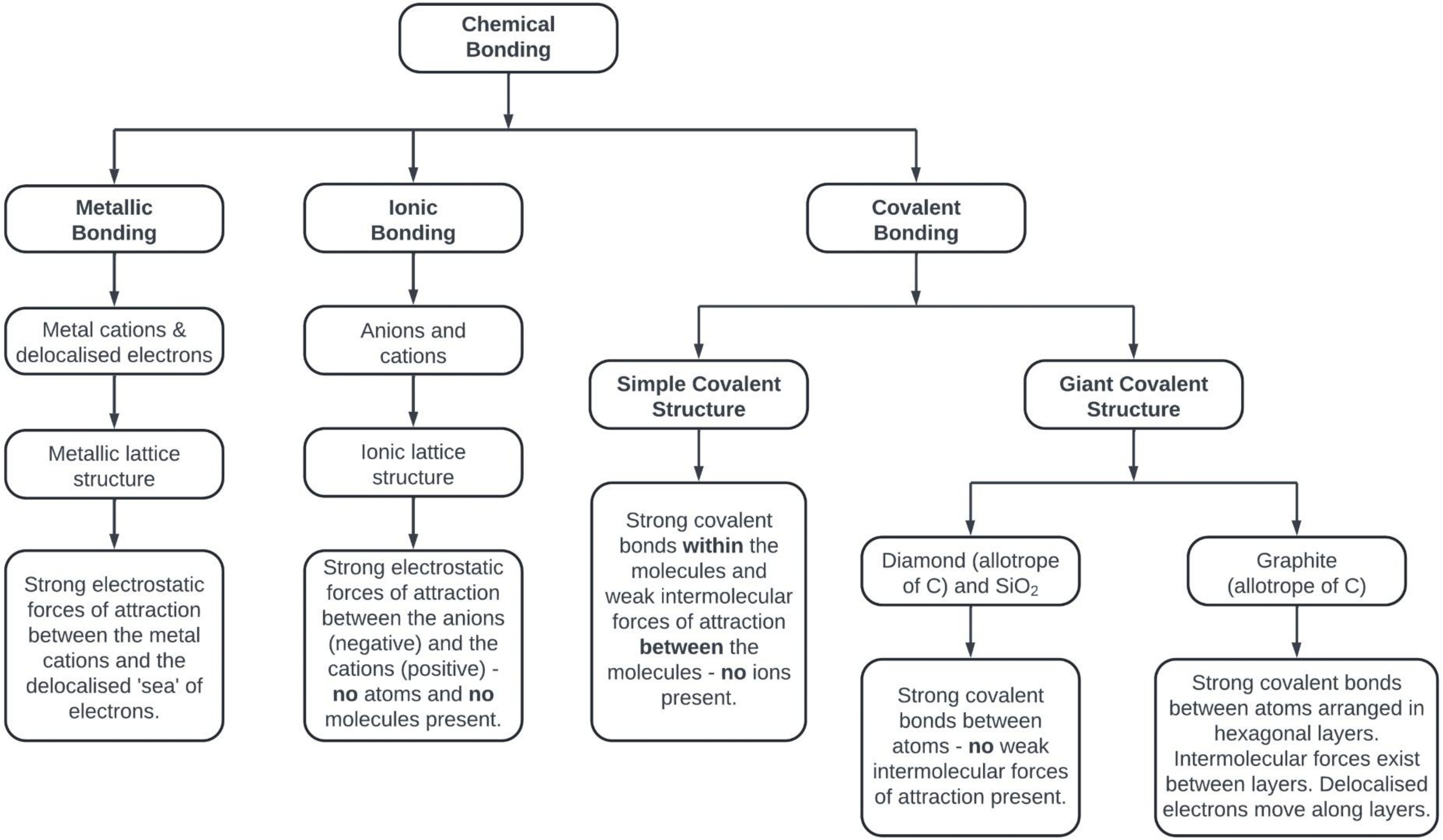
Chemical Bonding – Summary



Structure and Properties	**Giant Metallic Structure (*e.g.* Na, Mg)**	**Giant Ionic Structure (*e.g.* NaC*l*, MgO)**	**Giant Covalent / Macromolecular Structure (*e.g.* diamond, graphite, SiO_2)**	**Simple Covalent / Molecular Structure (*e.g.* CO_2, CH_4, H_2S)**
Melting Point and Boiling Point (This depends upon how strong the force of attraction between the particles is).	High. A large amount of energy is required to overcome the strong electrostatic force of attraction between the cations and delocalised 'sea' of electrons. Note: Melting points and boiling points generally increase as the charge on the cation increases.	High. A large amount of energy is required to overcome the strong electrostatic force or attraction between the oppositely charged ions (+ve anions and –ve cations).	High. A large amount of energy is required to break the strong covalent bonds between atoms in the giant covalent structure. Note: With the exception of graphite, there are **no** weak intermolecular forces of attraction in giant covalent structures.	Low. Only a small amount of energy is required to overcome the weak intermolecular force of attraction **between** molecules. Note: melting and boiling **do not** break the strong covalent bonds that hold the atoms together **within** the molecule.
Electrical Conductivity (This depends upon the availability of **mobile** charge carrying particles; electrons and ions).	Good conductor. This is due to the delocalised 'sea' of electrons. Note: There are no mobile ions (except in metals that are in their liquid state, *e.g.* mercury). Note: Electrical conductivity increases from Na to A*l* as the number of delocalised valence electrons increases.	Solid State: Non-conductor / electrical insulator. This is due to the absence of mobile charge carrying particles. There are **no** delocalised electrons, and the ions are held in fixed positions by strong electrostatic forces of attraction. Molten and aqueous: Good conductor. **Mobile** ions are present. The ions are now able to move as the strong electrostatic force of attraction between the oppositely charge ions are weakened during melting / dissolution. Note: There are **no** delocalised electrons in ionic compounds.	Diamond: Non-conductor / electrical insulator. There are **no** mobile charge carrying particles. There are **no** mobile ions present, only neutral atoms that are held in fixed positions. There are **no** delocalised electrons – all four valence electrons of each carbon atom are used to form four covalent bonds to the neighbouring carbon atoms in a tetrahedral arrangement. Graphite: There are **no** mobile ions present, only neutral atoms that are held in fixed positions. Three of the four valence electrons of each carbon atom are used to form three covalent bonds to the neighbouring carbon atoms in a layered arrangement. The forth valence electron of each carbon atom is delocalised between the layers, allowing graphite to conduct.	Non-conductor / electrical insulator due to the absence of **mobile** charge carrying particles – there are **no** mobile ions and **no** delocalised electrons. Note: Acids are covalent compounds that ionise as they dissolve in water. The presence of mobile ions allows aqueous acids to conduct electricity.
Solubility in Water & Organic Solvents (Water is a polar solvent while organic solvents are considered to be non-polar).	Insoluble in both water and organic solvents. Note: Some metals, such as Group 1 metals, may **react** with water, *e.g.* $2Na + 2H_2O \rightarrow 2NaOH + H_2$	Generally soluble in water but insoluble in organic solvents. Note: Refer to the solubility rules to determine which ionic compounds are insoluble in water, *e.g.* AgC*l* and PbC*l*$_2$.	Insoluble in both water and organic solvents.	Insoluble in water but soluble in organic solvents. Note: Ammonia, ethanol, glucose and hydrogen chloride are covalent compounds that dissolve in water. Acids are covalent compounds that ionise as they dissolve in water.