

Summary sheet 1: Structure and bonding

Words used to describe structure and bonding:

- ions, atoms, molecules, intermolecular forces, electrostatic forces, delocalised electrons, cations, anions, outer electrons, shielding

Metallic bond: electrostatic attraction between the nuclei of cations (positive ions) and delocalised electrons.

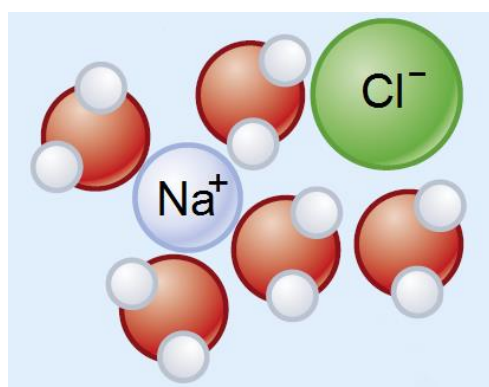
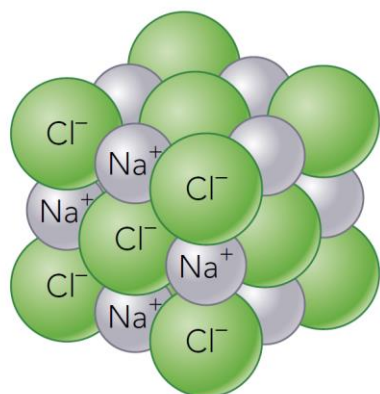
Strength of the metallic bonding increases with the number of valence electrons (outer electrons in the atoms) and with decreasing size of the cation.

Ionic bonds and ionic compounds

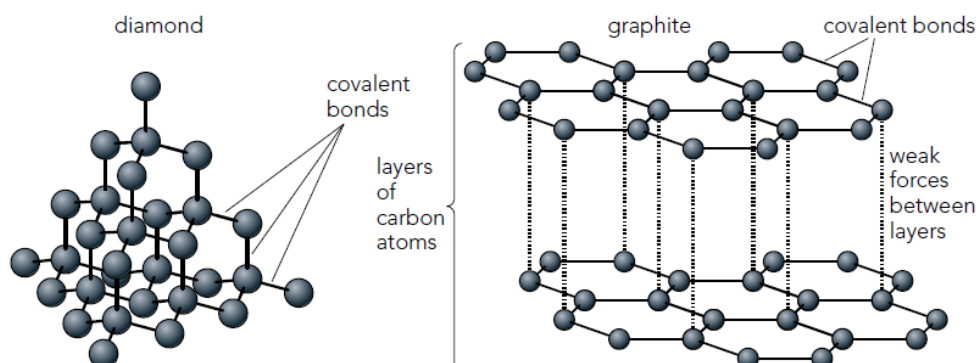
Explain why NaCl has a high melting point and only conducts electricity when molten or in solution. (6 marks)

An answer should cover the following points.

- 1 The Na^+ and Cl^- ions are held by strong electrostatic forces.
- 2 To melt solid NaCl, energy is needed to separate overcome the forces of attraction sufficiently for the lattice structure to break down and for the ions to be free to slide past one another.
- 3 Even though the ions are charged, the solid cannot conduct electricity because the ions are not mobile (free to move).
- 4 If the solid is melted, the ions can move freely and allow the liquid to conduct electricity.
- 5 Also, when dissolved in water the *ions* are separated by the water molecules and so are free to move, hence the aqueous solution can conduct electricity.



Summary sheet 2: Diamond and graphite structures

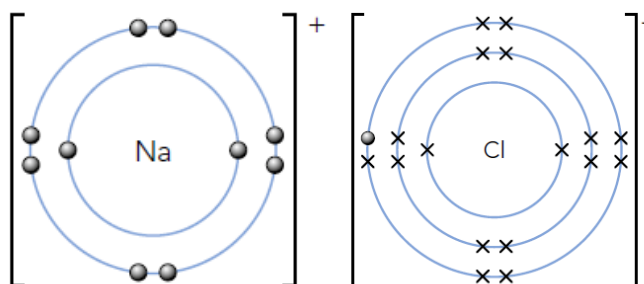
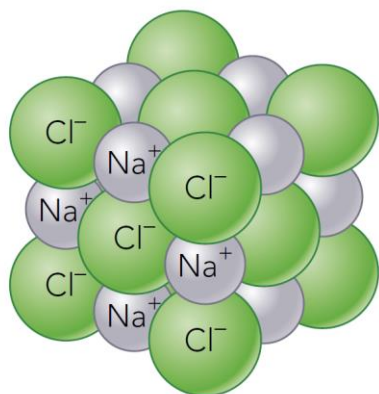


Property	Diamond	Graphite
Melting point	High – atoms held by strong covalent bonds. Many covalent bonds must be broken to melt it. Is solid at room temp.	High – atoms held by strong covalent bonds. Many covalent bonds must be broken to melt it. Is a solid at room temp.
Electrical conductivity	Poor – no mobile electrons available. All 4 outer electrons of each carbon are used in bonding.	Good – each carbon only uses 3 of its outer electron to form covalent bonds. 4 th electron from each atom contributes to a delocalised electron system. These delocalised electrons can flow when a potential difference is applied parallel to the layers.
Lubricant	Poor – structure is rigid.	Gas molecules are trapped between the layers and allow the layers to slide past one another. Same reason for its use in pencils.
Solubility	Insoluble in water – no charged particles to interact with water (think of SiO ₂ , main component of sand).	Insoluble in water – no charged particles to interact with water (think of SiO ₂ , main component of sand).

Using key words to describe ionic structure

Describe and explain how the structure of sodium fluoride is formed.

Use knowledge of the structure of sodium chloride



Which key words will you need?

- Attraction
- Electrostatic
- Tight
- Non-metals
- Giant
- Packed
- Anions
- Strong
- Metals
- Forces
- Ionic
- Opposition
- Lattice
- Cations

Tip

For questions about the physical properties of ionic compounds, relate the properties to their bonding and structure.

Property	Why?
Does not conduct electricity when solid.	
Conducts electricity when molten or in aqueous solution.	
	The ions are held by strong electrostatic forces of attraction and a large amount of energy is needed to overcome the attractions.
	The ions are tightly packed together.