Chemistry 2.4
Structure, bonding and Thermodynamics

Ionic solids

Ionic solids

- Ionic compounds contain positive and negative ions
- The ions are arranged in a regular 3D lattice. Each positive ion is surrounded by a **fixed** number of negative ions and vice versa.
- The chemical formula is the **ratio** between cation and anion (which is different to discrete molecular substance)

eg. For NaCl… each sodium ion is surrounded by 6 chloride ions and each chloride is surrounded by 6 sodium ions

Melting and boiling point

- The bonds which hold ionic solids together are the **strong electrostatic force** between **positive** charged and **negative** charged **ions**
- This electrostatic attraction is **strong** and require **lots of energy** to overcome
- Therefore **ionic solid** has a **high melting** and **boiling point**

Conductivity

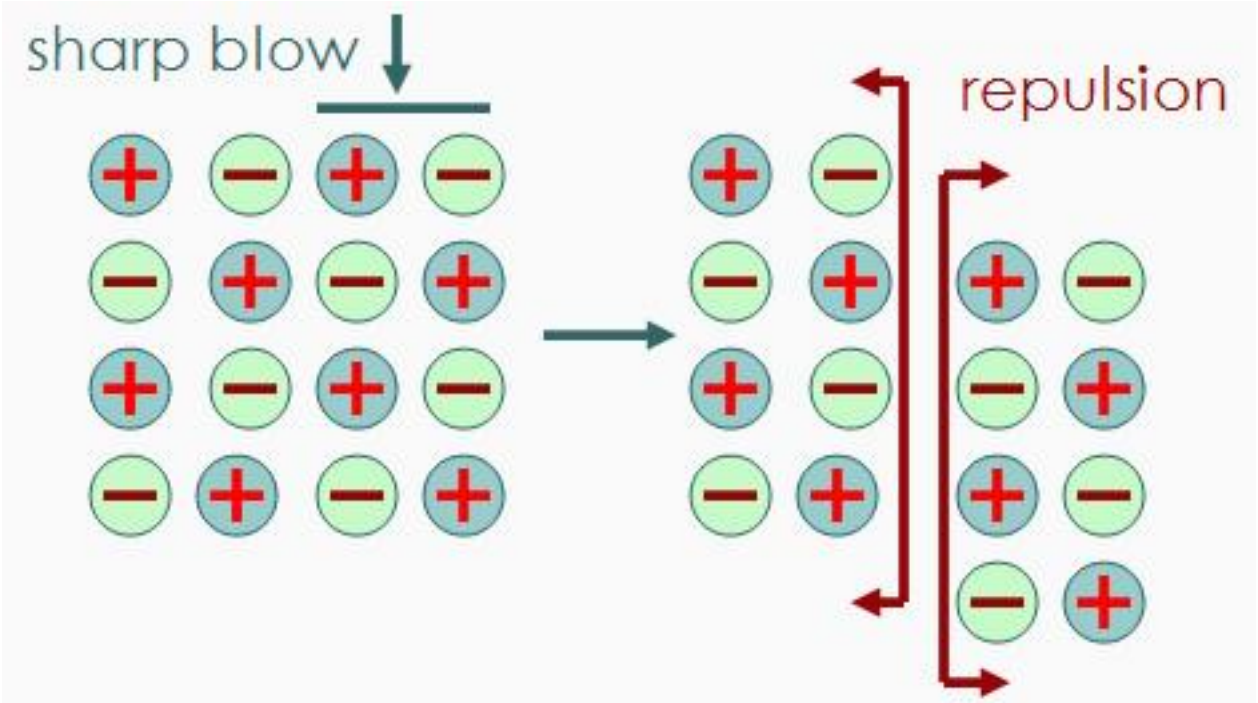
- **Ions** are firmly in position and **are NOT free to move** within the 3D lattice.
- Therefore ionic solid does not conduct electricity since there are **no MOVEABLE particles**
- On the other hand **ions are free to move** if it is **in solution**
- As well as **molten**
- Meaning ionic compounds are able to **conduct electricity** when it is in **solution or molten**

Overall **no conductivity in solid**

Conductivity in solution and liquid

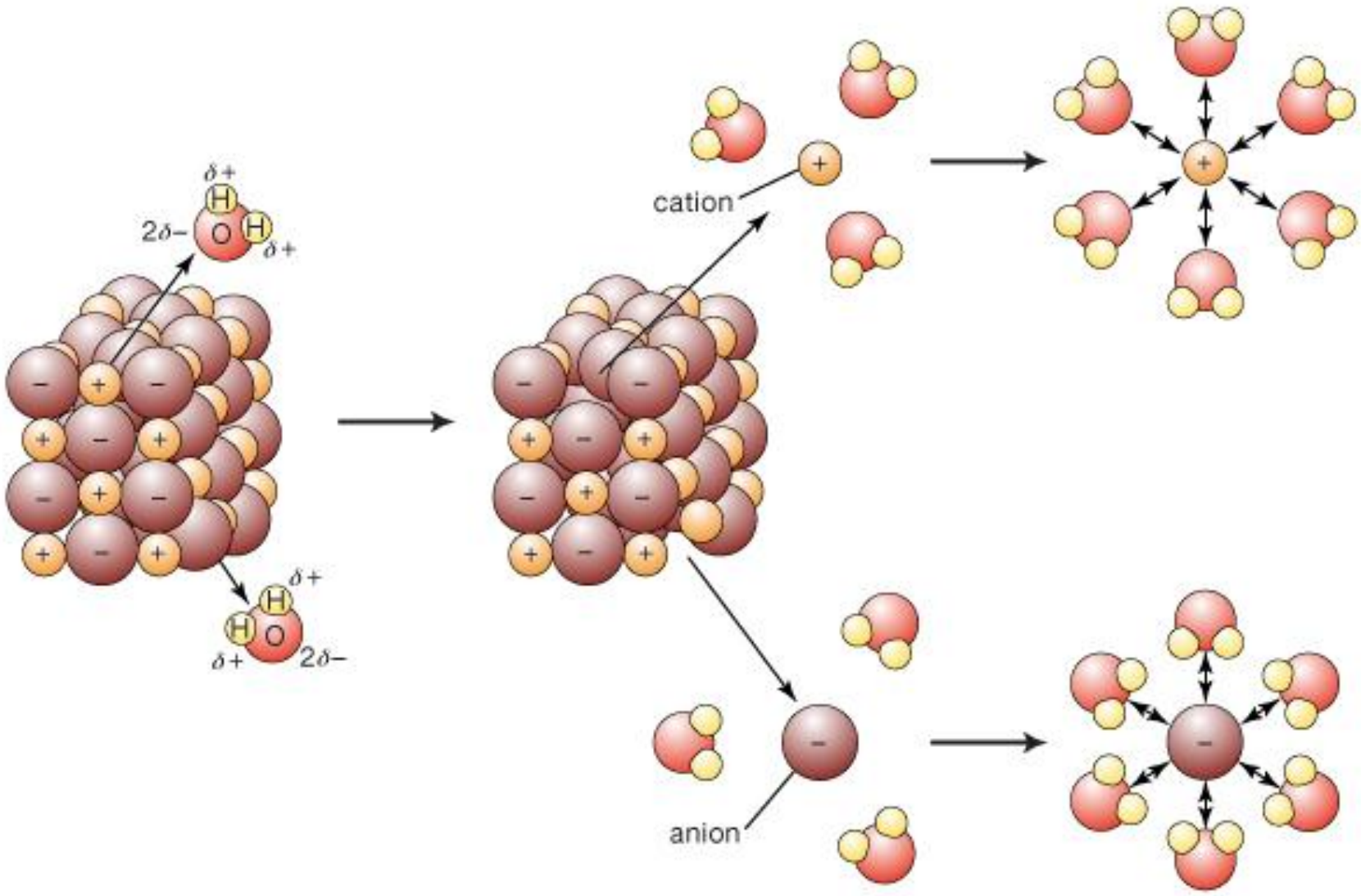
Malleability and Ductility

- Malleable and Ductile
  - Ionic substance are not malleable or ductile
  - They are brittle
  - If an attempt is made to distort a crystal, the ions move so that ions of the same charge will be next to each other
  - Since the same charge repel, this will result fractures in the lattice
  - In another word the ionic 3D lattice is rigid


sharp blow
repulsion

Solubility

- Many ionic solid dissolves in polar solvent like water.
- The cations are surrounded by the negatively charged oxygen atoms in the water molecules
- The anions are surrounded by the positively charged hydrogen atoms in the water molecules


δ+
H
2δ−
O
H
δ+
δ+
H
H
O
δ+
δ+
2δ−
cation
anion