

3.3 METALLIC BONDING

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Learning outcomes

By the end of this chapter, Students should be able to:

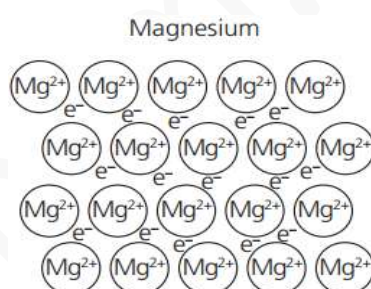
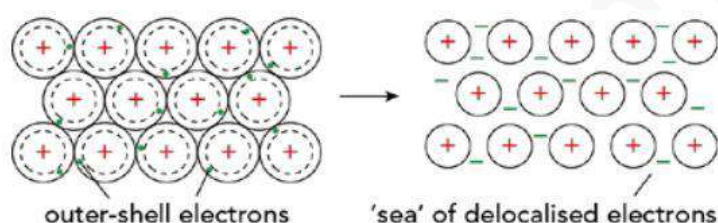
- define metallic bonding and draw an illustration

What is a metallic bond?

[GCSE Chemistry - Metallic Bonding #20 \(youtube.com\)](#)

In a metal, the atoms are packed closely together in a regular arrangement called a **lattice**. Metal atoms in a lattice tend to lose their outer shell electrons and become positive ions. The outer shell electrons occupy new energy levels and are free to move throughout the metal lattice. We call these electrons **delocalised electrons** (mobile electrons). Delocalised electrons are electrons that are not associated with any one particular atom or bond.

Metallic bonding is strong. This is because the ions are held together by the strong electrostatic attraction between their positive charges and the negative charges of the delocalised electrons.



This electrostatic attraction acts in all directions. The strength of metallic bonding increases with:

- increasing positive charge on the ions in the metal lattice
- decreasing size of metal ions in the lattice
- increasing number of mobile electrons per atom.

Most metals have high melting points and high boiling points

It takes a lot of energy to weaken the strong attractive forces between the metal ions and the delocalized electrons. These attractive forces can only be overcome at high temperatures.

Metals conduct electricity

When a voltage is applied to a piece of metal, an electric current flows in it because the delocalized electrons (mobile electrons) are free to move. Metallic bonding is the only type of bonding that allows us to predict reliably that a solid will conduct electricity. Covalent solids cannot conduct electricity because none of their electrons are free to move throughout the structure, although graphite is an exception to this. Ionic solids cannot conduct because neither their electrons nor their ions are free to move from place to place.

Metals conduct heat

The conduction of heat is partly due to the movement of the delocalised electrons but mainly due to the vibrations passed on from one metal ion to the next.