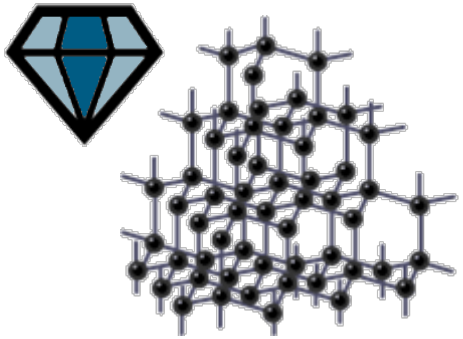
Allotropes of Carbon

Different arrangements of the same atoms (in this case, carbon) can have very different properties. These arrangements are called allotropes, and there are several of carbon, but the main ones are:

Diamond



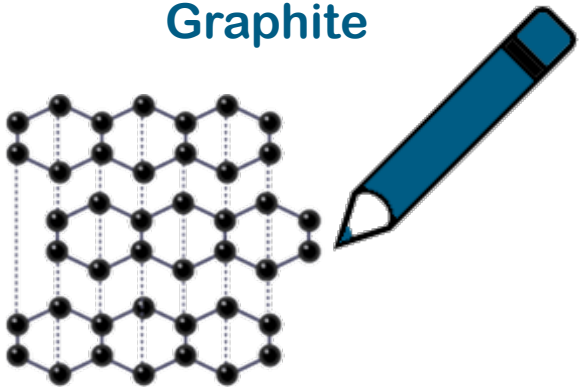
Giant molecular structure, each Sp^3 carbon atom is joined to another by **4 bonds**.

The rigid network of carbon atoms and bonds make diamond a very hard material. It also gives it a high melting point (almost 4000 °C).

This makes it useful for heavy drill bits and other cutting instruments that need to be very strong. We can make synthetic diamonds for this.

It is insoluble in water and organic solvents, and there are no free electrons, or ions, so it does **not conduct electricity**.

Graphite

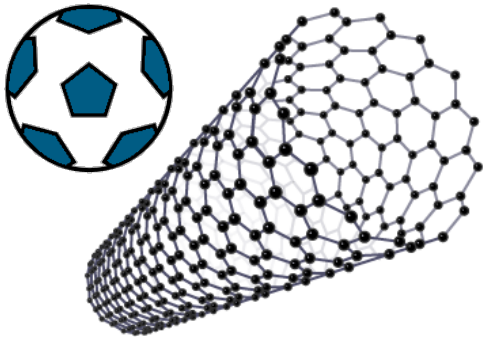


Giant molecular structure, each carbon atom is joined to another by **3 bonds**.

These form sheets with a hexagonal layered structure. Each layer is very strong, with a high melting point, but the layers are joined by weak Van de waals forces between them and slide over each other, it can be used in a pencil, or as a lubricant.

It is insoluble in water and organic solvents, the free electron is delocalised along the layers, allowing **conduction of electricity**.

Nanoparticles



Molecular structures, each carbon atom is joined to another by **3 bonds**, but forms closed tubes or hollow balls.

The first example was C_{60} – this has a football shape with pentagons and hexagons. It won the Nobel Prize in 1996. It can be used to cage other molecules for research or even for medical purposes.

These nanoparticles can also form nanotubes, that **conduct electricity** and give a massive surface area, which is useful for industrial catalysts.