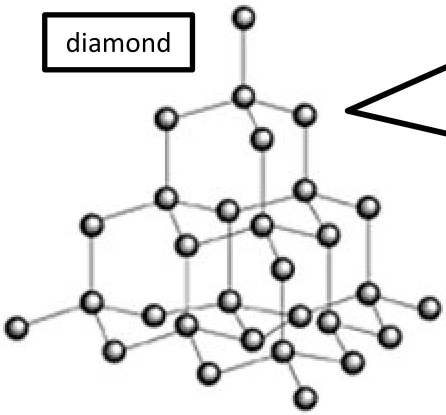
GCSE CHEMISTRY CORE KNOWLEDGE 3
Giant Covalent, Polymers, Metallic Bonding and Alloys

name:

Giant Covalent Structures

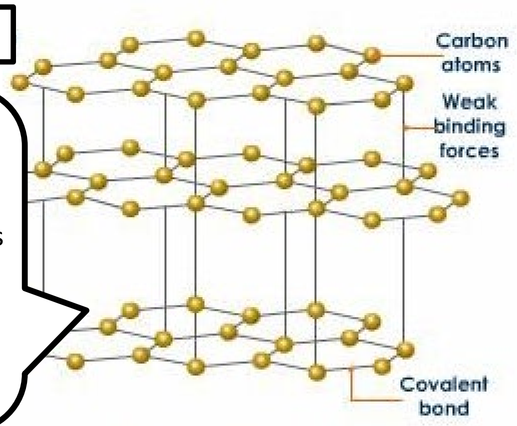
Substances with giant covalent structures are solids with very high melting points.
All the atoms are linked by strong covalent bonds, which must be broken to melt the substance.
Examples are diamond, graphite (types of carbon) and silicon dioxide (silica).

diamond

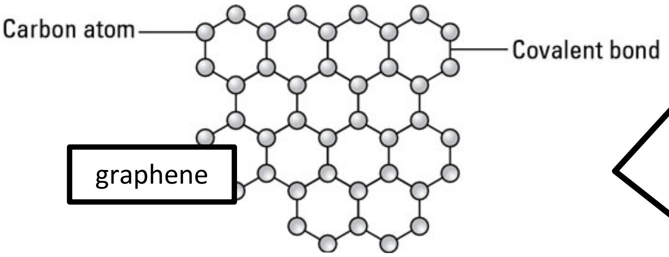


Diamond:
- is a form of carbon
- each C atom has FOUR covalent bonds
- **very hard** – because the covalent bonds are strong
- **very high melting point** – because lots of energy is needed to break the bonds
- **doesn't conduct electricity** – because there are no moving charges

graphite

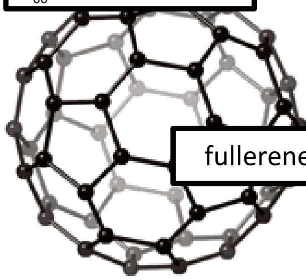


Graphite:
- is a form of carbon
- each C atom forms THREE covalent bonds
- layers of hexagonal rings, with no covalent bonds between the layers
- **high melting point** – because lots of energy is needed to break the bonds
- **soft** – because the layers can slide easily
- **conducts electricity** – one electron from each atom is delocalised (similar to metals)

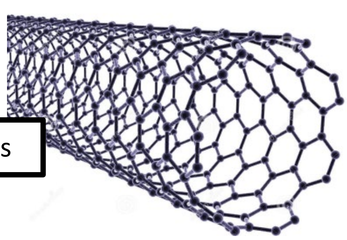


graphene

C_{60} buckminsterfullerene



fullerenes

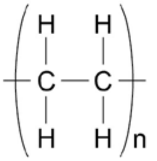


Graphene:
- graphene is a single layer of graphite
- graphene is useful in electronics and composites

Fullerenes:
- fullerenes have hexagonal rings of carbon atoms (but also rings with 5 or 7 C atoms) to form hollow shapes
- the first fullerene discovered was C_{60} which is a sphere
- carbon nanotubes are cylinders – high length to diameter ratio = useful in nanotech and electronics

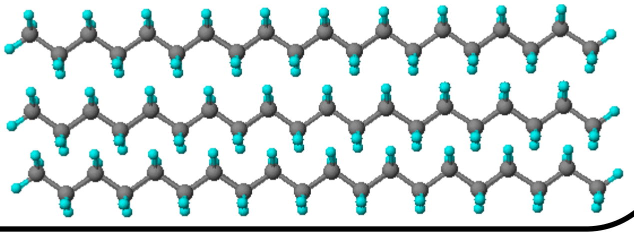
Polymers

Polymers are long chain molecules. The formula can be shown like this (where n is a large number):



poly(ethene)

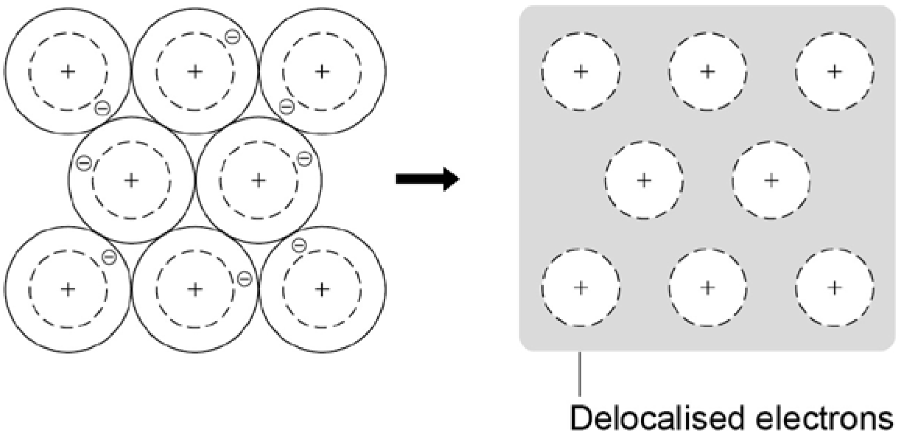
The atoms in polymers are joined by covalent bonds. In between the polymer chains, there are quite strong intermolecular forces, so polymers are solids at room temperature.



Metallic bonding

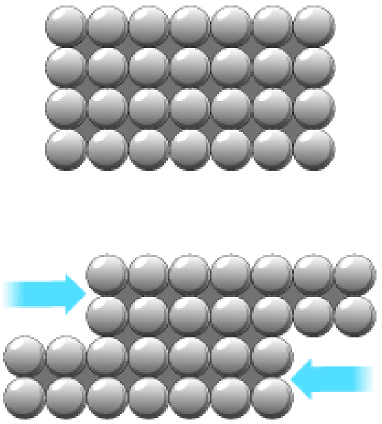
Metals have giant structures of atoms in a regular pattern.

The electrons in the outer shell are ***delocalised***, so are free to move.



Properties of Metals

- **high melting and boiling points** – because there is strong metallic bonding between atoms
- **can be bent and shaped** – because the atoms are arranged in layers
- **good conductors of electricity** – because the delocalised electrons carry electrical charge through the metal
- **good conductors of thermal energy (heat)** - because energy is transferred by the delocalised electrons



Alloys

- pure metals are too soft for many uses
- an alloy is a metal with a mixture of atoms
- alloys are **harder** than pure metals because the different sizes atoms means the layers can't easily slide