



GCSE CHEMISTRY

COMPONENT 2

Applications in Chemistry

HIGHER TIER

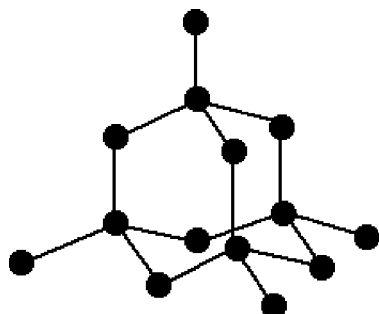
**RESOURCE BOOKLET
for use in Section A**

Allotropes of carbon

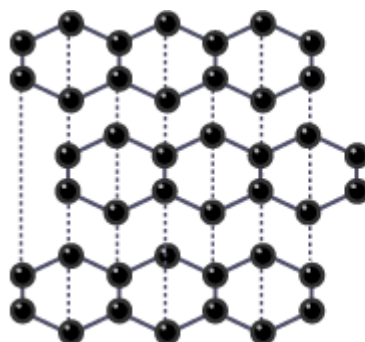
Carbon exists as a number of different allotropes. Some important allotropes of carbon are described in this article.

Diagram 1 Diamond and graphite

Diamond

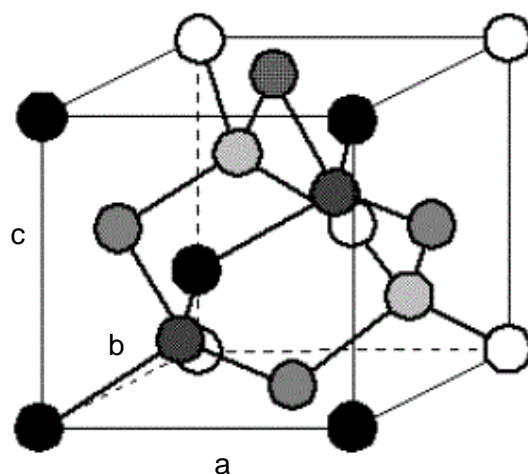


Graphite



The structure of diamond can be related to a cube. The diagram below shows this.

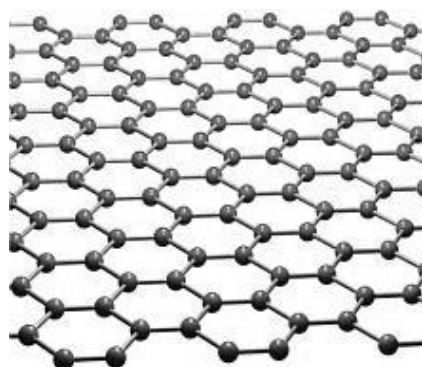
Diagram 2 A unit cubic cell of diamond



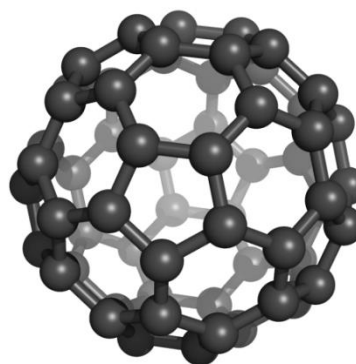
The cell dimension $a = b = c = 0.36 \text{ nm}$

Diagram 3 Graphene and fullerene

Graphene



Fullerene



Graphene and fullerenes

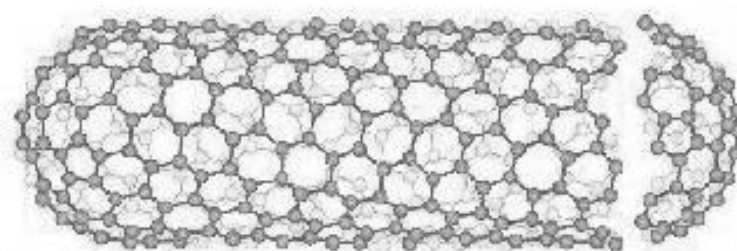
Graphene is a single sheet with the carbon atoms arranged in the layer as they are in graphite.

Fullerenes are cage-like spherical molecules. They were first discovered using a method known as mass spectroscopy. One fullerene identified by mass spectrometry had a relative molecular mass of 720.

Carbon nanotubes

Carbon nanotubes are made of graphene sheets rolled into the shape of a cylinder, often with at least one end closed.

Diagram 4 Carbon nanotube



Properties of carbon nanotubes

The **specific strength** is a material's tensile strength divided by its density. It is also known as the **strength-to-weight ratio**.

Another way to describe specific strength is **breaking length** which is the maximum length of a vertical column of the material that could support its own weight when suspended only at the top.

Table 1

Material	Tensile strength (MPa)	Density (g/cm ³)	Specific strength (kN m/kg)	Breaking length (km)
stainless steel	505	8.00	63.1	6.4
aluminium	572	2.81	204	20.8
kevlar	3 620	1.44		
carbon nanotube	62 000	1.34	46 268	4 716