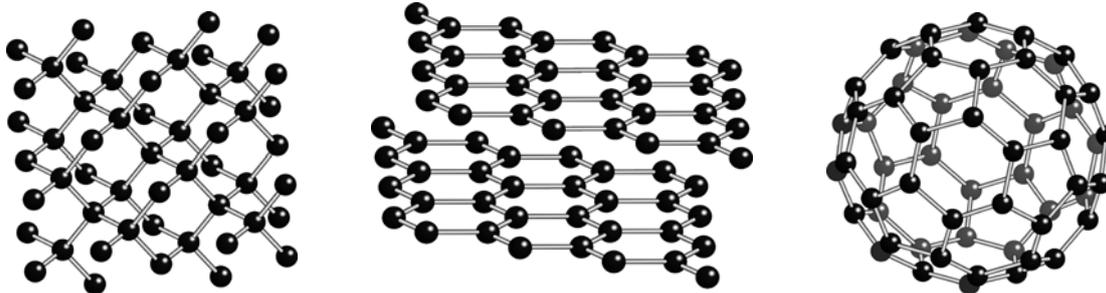


Carbon –

The element with several identities



1. **What does the word allotrope mean?**

Different forms of the same element in the same state.

2. **Name the three different allotropes of carbon.**

Diamond, graphite, buckyball or C_{60}

3. **In what ways are the three structures a) similar b) different?**

Similar: Diamond and graphite are giant 3D structures with a variable number of C atoms. Diamond and graphite have high melting points.

Different: C_{60} is a small molecule – with a fixed number of C atoms (60!). In diamond each carbon atom is joined to 4 other atoms. In graphite each carbon atom is joined to 3 others, the 4th being used to create a weak bond between the layers. C_{60} has C atoms arranged in hexagons & pentagons in a structure resembling a soccer ball. C_{60} has a much lower melting point.

4. **Which type of carbon;**

a) is the hardest – *diamond*

b) conducts electricity – *graphite*

c) will dissolve in oil – *C_{60}*

d) is used to write with - *graphite*

5. **Explain your answers to question 4.**

is the hardest – diamond. *Each C atom is bonded to 4 others in a regular tetrahedral arrangement; breaking diamond means these strong bonds between carbon atoms have to be broken and this is why diamond is hard.*

conducts electricity – graphite *There are delocalised (free) electrons between the layers that are free to move & carry a electric current.*

will dissolve in oil – C_{60} – *because it is a small molecule like oil (It is a non-polar molecule, like oil, and “like dissolves like”).*

is used to write with – graphite – *because the layers in graphite are only weakly attracted to each other and slide easily over each other and will slide off and leave a mark on paper. (Graphite has strong bonds within layers but only weak bonds between layers).*