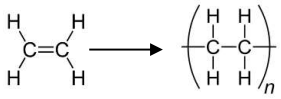
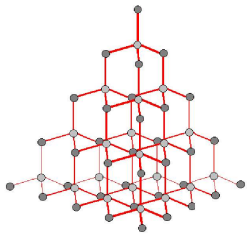
# Knowledge Organiser - Bulk Properties

# L96 - 102
# BONDING, STRUCTURE AND THE PROPERTIES OF MATTER 2

## Polymers

| | | | |
|---|---|---|---|
| Very large molecules | *Solids at room temperature* | Atoms are linked by strong covalent bonds. |  |

## Diamond

| | | | |
|---|---|---|---|
| *Each carbon atom is bonded to four others* |  | Very hard. | Rigid structure. |
| | | Very high melting point. | Strong covalent bonds. |
| | | Does not conduct electricity. | No delocalised electrons. |

## Giant covalent structures

| | | |
|---|---|---|
| Diamond, graphite, silicon dioxide | *Very high melting points* | Lots of energy needed to break strong, covalent bonds. |

## Properties of small molecules

| | | | |
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| Usually gases or liquids | *Covalent bonds in the molecule are strong but forces between molecules (intermolecular) are weak* | Low melting and boiling points. | Due to having weak intermolecular forces that easily broken. |
| | | Do not conduct electricity. | Due to them molecules not having an overall electrical charge. |
| | | Larger molecules have higher melting and boiling points. | Intermolecular forces increase with the size of the molecules. |

## Covalent bonding

| | | |
|---|---|---|
| Atoms share pairs of electrons | *Can be small molecules e.g. ammonia* | Dot and cross :<br>+ Show which atom the electrons in the bonds come from<br>- All electrons are identical<br><br>2D with bonds:<br>+ Show which atoms are bonded together<br>- It shows the H-C-H bond incorrectly at 90°<br><br>3D ball and stick model:<br>+ Attempts to show the H-C-H bond angle is 109.5° |
| | *Can be giant covalent structures e.g. polymers* | |

## Graphene and fullerenes

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| Graphene | *Single layer of graphite one atom thick* | Excellent conductor. | Contains delocalised electrons. |
| | | Very strong. | Contains strong covalent bonds. |

| | | |
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| Fullerenes | Buckminsterfullerene, $C_{60}$<br>First fullerene to be discovered. | Hexagonal rings of carbon atoms with hollow shapes. Can also have rings of five (pentagonal) or seven (heptagonal) carbon atoms. |

| | | | |
|---|---|---|---|
| Carbon nanotubes | *Very thin and long cylindrical fullerenes* | Very conductive. | Used in electronics industry. |
| | | High tensile strength. | Reinforcing composite materials. |
| | | Large surface area to volume ratio. | Catalysts and lubricants. |

## Size of particles and their properties (Chemistry only)

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| Nanoparticles | *Between 1 and 100 nanometres (nm) in size* | 1 nanometre (1 nm) = 1 x $10^{-9}$ metres (0.000 000 001m or a billionth of a metre). |

## Use of nanoparticles

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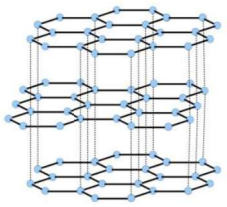
| *Healthcare, cosmetics, sun cream, catalysts, deodorants, electronics.* | Nanoparticles may be toxic to people. They may be able to enter the brain from the bloodstream and cause harm. |

## Graphite

| | | | |
|---|---|---|---|
| *Each carbon atom is bonded to three others forming layers of hexagonal rings with no covalent bonds between the layers* |  | Slippery. | Layers can slide over each other. |
| | | Very high melting point. | Strong covalent bonds. |
| | | Does conduct electricity. | Delocalised electrons between layers. |

*'Aim For Excellence'*