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| --- | --- | --- | --- |
| **IMFs** | Dispersion forces – nature and origin   * Weakest of IMFs * Random movement of electrons means that at any one point in time electrons may be unevenly distributed around an atom/molecule. This results in a temporary dipole * Repulsion/attraction of electrons in neighbouring atoms/molecules causes induced dipoles * Dipoles with opposing charges have a weak electrostatic attraction * Diagram   https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQojwNdMaqBK7kZOscRR7xvfWF5gt4akqv2xfJfaghFMIYEeQh8 | 4 |  |
| Dipole – Dipole forces *-* nature and origin   * Difference in electronegativity of bonded atoms will cause uneven sharing of electrons in covalent molecular substances * Depending on the shape of the molecule, this can create an overall dipole * Dipoles with opposing charges have an electrostatic attraction * Diagram   http://chemed.chem.purdue.edu/genchem/topicreview/bp/intermol/graphics/inter2.gif | 4 |  |
| H- bonding - nature and origin   * Strongest type of IMF * Large difference in electronegativity between H and N,O or F results in a particularly strong dipole * Dipoles with opposing charges have an electrostatic attraction * Diagram   http://www.physicsofmatter.com/NotTheBook/Talks/Ice/Image7.gif | 4 |  |
| **Trends** | Trends are described   * Graphs of boiling point versus period for the Group 14 hydrides shows increasing boiling point as size of the molecule increases. * Trend is similar for groups 15, 16 and 17, with the exception of H20, HF and NH3 * H20, HF and NH3 show higher boiling points than “expected” | 4 |  |
| Trends are explained   * Increased boiling point within each group is due to increased dispersion forces between molecules. * There are more dispersion forces due to the increased number of electrons going across periods. * H20, HF and NH3 do not follow the same trend as other molecules in their respective groups because there are additional IMFs between molecules. * Additional IMFs between H20, HF and NH3 are H bonds. Stronger than dispersion forces and therefore more energy required to separate the molecules, indicated by higher boiling points | 4 |  |
| **Quality of writing** | Characteristics of excellent answer:  - Well organized ideas that flow easily  - Excellent use of vocabulary, including relevant scientific terms  - Use of subheadings and paragraphs to effectively order ideas  - Concise language – lack of needless repetition  - Use of labelled diagrams and/or tables where appropriate  - Legible writing with minimal spelling errors | 2.5 |  |