Topic 3: Molecules

Knowledge	Application

Subtopic 3.1: Molecule Polarity

The shapes of molecules can be explained and predicted using three-dimensional representations of electrons as charge clouds, and using valence-shell electron-pair repulsion (VSEPR) theory.	Draw and annotate diagrams showing covalent bonds, non-bonding pairs, and shapes of molecules and ions in which there is only one central atom and up to eight valence electrons.
The polarity of a molecule results from the polar character of the bonds and their spatial arrangement.	Predict and explain whether or not a molecule is polar, given its spatial arrangement

Subtopic 3.2: Interactions Between Molecules

The physical properties of molecular substances can be explained by considering the nature and strength of the forces of attraction between the molecules. Secondary interactions between molecules are much weaker than primary metallic, ionic, and covalent bonds. The shape, polarity, and size of molecules can be used to explain and predict the nature and strength of secondary interactions. Dispersion forces exist between all molecules. Their strength depends on the size and shape of the molecules.	Predict the relative strengths of interactions between molecules, given relevant information.
Dipole–dipole interactions exist between polar molecules and their strength depends on the polarity and size of the molecules. Hydrogen bonding is a particularly strong form of dipole–dipole interaction that exists between molecules.	Draw diagrams showing partial charges and hydrogen bonding between HF, H_2O, and NH_3 molecules. Explain the boiling points of HF, H_2O, and NH_3 in terms of hydrogen bonding between the molecules.

Subtopic 3.3: Hydrocarbons

Carbon forms hydrocarbon compounds, including alkanes and alkenes. The physical properties of hydrocarbons depend on the size of the molecules.	Compare the melting and boiling points of hydrocarbons, given relevant information.
Hydrocarbons are used as fuels and as feedstock for the chemical industry.	Write equations for the complete combustion of hydrocarbons.
The chemical reactions of hydrocarbons are determined by the functional groups present.	Predict the product of an addition reaction of an alkene.
Hydrocarbons can be represented by empirical formulae, molecular formulae, and structural formulae, including extended, condensed, and skeletal representations. Hydrocarbons can exist as different structural isomers. Hydrocarbons are named systematically to provide unambiguous identification. The structural formula of a hydrocarbon can be deduced from its systematic name. Organic molecules have a hydrocarbon skeleton and can contain functional groups.	Identify, name systematically, and draw structural formulae of hydrocarbons containing: • up to eight carbon atoms in the main chain, with side chains limited to a maximum of two carbon atoms • one or more alkene groups.

Subtopic 3.4 on next page.

Subtopic 3.4: Polymers

Knowledge	Application
Polymers or macromolecules are very large molecules composed of small repeating structural units.	Identify the repeating unit of a polymer, given the structural formula of a section of a chain.
Addition polymerisation occurs when monomer molecules link without the loss of atoms. Addition polymers can be synthesised from alkene monomers. Organic polymers have diverse properties and uses. The properties of organic polymers depend on the interactions between the polymer chains.	Draw the structural formula of an addition polymer that could be produced from monomers containing one carbon–carbon double bond, given the structural formula(e) of the monomer(s) or vice versa.