The Sutton Academy

# Knowledge Rich Curriculum Plan

SCIENCE- Chemistry Year 11

Organic Chemistry

| Lesson/Learning Sequence | Intended Knowledge:<br>*Students will know that…* | Prior Knowledge:<br>*In order to know this, students need to already know that…* | Working Scientifically | Tiered Vocabulary and Reading Activity |
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| Lesson:<br>Crude Oil | • Students will know that crude oil is a finite resource found in rocks<br>• *Students will know that crude oil is the remains of ancient biomass* | • ***Students need to already know that crude oil is found in the ground***<br>• ***Students need to already know that crude oil is a fossil fuel*** | | *Tier 2*<br><br>*Finite: a resource that won't naturally replenish* |

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| | *consisting mainly of plankton buried in mud.*<br>• *Students will know that crude oil is a mixture of a very large number of compounds*<br>• *Students will know that hydrocarbons are molecules that contain hydrogen and carbon only.*<br>• *Students will know that most of the compounds in crude oil are hydrocarbons*<br>• *Students will know that alkanes are a type of hydrocarbon*<br>• *Students will know that alkanes have the general formula $C_nH_{2n+2}$.*<br>• *Students will know that the first for alkanes are methane (1 C), ethane (2 C), propane (3 C) and butane (4 C).*<br>• *Students will know how to draw the first 4 alkanes.*<br>• *Students will know how to work out the formulae of alkanes from a given number of carbons or hydrogens.* | | | *Tier 3*<br><br>*Biomass: matter from living organisms*<br><br>*Plankton: microscopic organisms found in the sea or fresh water*<br><br>*Hydrocarbon: a molecule containing hydrogen and carbon atoms only* |
| Lesson: Fractional Distillation | • **Students will know that fractions are groups of hydrocarbons that contain molecules with similar number of carbon atoms**<br>• *Students will know that crude oil can be separated in to the fractions using fractional distillation*<br>• *Students will know that fractions can be processed to produce fuels and feedstock for the petrochemical industry.*<br>• *Students will know that we use a lot of the products from fractions.* | ***Students need to already know that crude oil is a mixture of hydrocarbons.***<br>*Students need to already know that boiling is the change of state from liquid to gas*<br>*Students need to already know that condensation is the change of state from gas to liquid* | *Interpreting Data* | *Tier 2*<br><br>*Tier 3*<br><br>*Fractions: a group of molecules that have similar boiling points* |

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| | • *Students will know that fractional distillation works through evaporation and condensation.*<br>• *Students will know that the different fractions are separated by their boiling points.* | | | |
| Lesson: Properties of Hydrocarbons | • *Students will know that as hydrocarbons get longer, the boiling point increases*<br>• *Students will know that as hydrocarbons get longer, the viscosity increases*<br>• *Students will know that as hydrocarbons get longer, the flammability decreases.*<br>• *Students will know that combustion is the reaction between hydrocarbons and oxygen, and releases a lot of energy.*<br>• *Students will know how to write equations for the combustion of hydrocarbons.* | ***Students need to already know that flammability is how easily something can set on fire***<br>*Students need to already know that boiling point is the temperature a substance boils at* | *Interpreting data* | *Tier 2*<br><br>*Viscosity: A measure of how thick a fluid is* |
| Lesson: Cracking and Alkenes | • Students will know that hydrocarbons can be broken down to produce smaller useful molecules.<br>• Student will know that the process of braking down the hydrocarbons is known as cracking.<br>• Students will know that cracking can be done using catalytic cracking and steam cracking.<br>• Students will know that catalytic cracking uses a temperature of around 550 °C and a zeolite catalyst.<br>• Students will know that steam cracking uses a higher temperature of over 800 °C and no catalyst. | ***Students need to already know that hydrocarbons can have different lengths***<br>Students need to already know that hydrocarbons contain carbon and hydrogen | Interpreting and analysing data | Tier 2<br><br>Decolourise: Remove colour<br><br>Tier 3<br><br>Cracking: a method used to split long alkane molecules into smaller molecules (an alkane and an alkene)<br><br>Catalyst: A substance that speeds up a chemical reaction without itself being used up |

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| | • Students will know that cracking alkanes produces a shorter alkane and an alkene.<br>• Students will know that alkenes are a type of hydrocarbon that contains a carbon carbon double bond.<br>• Students will know that when bromine water is added to alkenes it decolourises (orange to colourless), but it doesn't decolourise with alkanes.<br>• Students will know that there is a high demand for fuels with small molecules.<br>• Students will know how to write balanced equations for cracking.<br>• Students will know how to explain the importance of cracking. | | | |
| Lesson: Reactions of Alkenes (TRIPLE ONLY) | • Students will know that the reaction of functional groups of organic compounds determines the reactions of organic compounds.<br>• Students will know that alkenes combust, but they tend to burn with smoky flames compared to alkanes.<br>• Students will know that alkenes react with hydrogen, water and halogens.<br>• Students will know that the reaction of alkenes are addition reactions, so that double bond becomes a single carbon-carbon bond.<br>• Students will know how to draw the first 4 alkenes.<br>• Students will know how to draw the products of the addition reactions of alkenes. | *Students need to already know that alkenes are hydrocarbons with carbon-carbon double bonds.* | | Tier 2<br><br>Tier 3<br><br>Functional group: part of a molecule that determines how it reacts<br><br>Addition: reaction where groups are added to molecules |

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| **Lesson: Alcohols (TRIPLE ONLY)** | • Students will know that alcohols contain the function group -OH<br>• Students will know that methanol, ethanol, propanol and butanol are the first four members of the alcohols<br>• Students will know how to represent the first 4 alcohols.<br>• Students will know that alcohols react with sodium, oxygen and oxidising agents.<br>• Students will know how to represent the products of the reactions of alcohols.<br>• Students will know that ethanol is produced when sugar solutions are fermented using yeast. | Students need to already know that functional groups are parts of organic molecules | | Tier 2<br><br>Tier 3<br><br>Oxidising agent: substance that will oxidise another substance<br><br>Fermentation: The chemical breakdown of a substance using yeast<br><br>Yeast: a microscopic fungus |
| **Lesson: Carboxylic Acids (TRIPLE ONLY)** | • Students will know that carboxylic acids have the functional group -COOH<br>• Students will know that the first four members of the carboxylic acids are methanoic acid, ethanoic acid, propanoic acid and butanoic acid.<br>• Students will know how to represent carboxylic acids.<br>• Students will know that carboxylic acids react with carbonates and alcohols<br>• Students will know how to represent the products of reactions between carboxylic acids and carbonates and alcohols<br>• Students will know that carboxylic acids are weak acids | Students need to already know that a weak acid is an acid that only partially ionises. | | Tier 2<br><br>Tier 3<br><br>Weak acids: Acids that partially ionise |

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| **Lesson: Addition Polymerisation (TRIPLE ONLY)** | • Students will know that alkenes are used to make polymers through addition polymerisation.<br>• Students will know that in addition polymerisation many small molecules (monomers) join together to form very large molecules (polymers)<br>• Students will know how to represent addition polymers | Students need to already know that alkenes are hydrocarbons that contain carbon-carbon double bonds | | Tier 2<br><br>Tier 3<br><br>Monomer: small molecule that joins together to form polymers |
| **Lesson: Condensation Polymerisation (TRIPLE ONLY)** | • Students will know that condensation polymerisation involves monomers with two functional groups.<br>• Students will know that when condensation polymerisation takes place small molecules (such as water) are lost.<br>• Students will know that diols are compounds that contain two alcohol groups<br>• Students will know that dioic acids are compounds that contain to carboxylic acid groups<br>• Students will know how to represent the formation of condensation polymers. | Students need to already know that polymers are made up of monomers | | Tier 2<br><br>Tier 3<br><br>Diol: a molecule that contains 2 alcohol groups<br><br>Dioic acid: a molecule that contains two carboxylic acid groups |
| **Lesson: Amino Acids (TRIPLE ONLY)** | • Students will know that amino acids have two different functional groups in a molecule<br>• Students will know that amino acids react by condensation polymerisation to produce polypeptides.<br>• Students will know that different amino acids can be combined in the same chain to produce proteins<br>• Students will know how to represent condensation polymerisation of amino acids. | Students need to already know that amino acids make up protein | | Tier 2<br><br>Tier 3<br><br>Polypeptide: Polymer formed when amino acids combine through condensation polymerisation |

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| **Lesson: DNA and other polymers (TRIPLE ONLY)** | • Students will know that DNA is a large molecule.<br>• Students will know that DNA molecules are made up of two polymer chains, from 4 different monomers called nucleotides<br>• Students will know that examples of other naturally important polymers are cellulose, proteins and starch.<br>• Students will know that the monomer of cellulose and starch is glucose<br>• Students will know that the monomer of proteins is amino acids. | Students need to already know that DNA is a double helix | | Tier 2<br><br>Tier 3<br><br>Cellulose: polymer that is found in plant cell walls<br><br>Starch: naturally occurring polymer found in plant leaves<br><br>Nucleotide: monomer of DNA, containing sugar, phosphate group and a base. |