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**Knowledge Rich Curriculum Plan**

SCIENCE- Chemistry Year 11

Organic Chemistry

| **Lesson/Learning Sequence** | **Intended Knowledge:**  *Students will know that…* | **Prior Knowledge:**  *In order to know this, students need to already know that…* | **Working Scientifically** | **Tiered Vocabulary and Reading Activity** |
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| **Lesson:**  **Crude Oil** | * **Students will know that crude oil is a finite resource found in rocks** * *Students will know that crude oil is the remains of ancient biomass consisting mainly of plankton buried in mud.* * *Students will know that crude oil is a mixture of a very large number of compounds* * *Students will know that hydrocarbons are molecules that contain hydrogen and carbon only.* * *Students will know that most of the compounds in crude oil are hydrocarbons* * *Students will know that alkanes are a type of hydrocarbon* * *Students will know that alkanes have the general formula CnH­2n+2.* * *Students will know that the first for alkanes are methane (1 C), ethane (2 C), propane (3 C) and butane (4 C).* * *Students will know how to draw the first 4 alkanes.* * *Students will know how to work out the formulae of alkanes from a given number of carbons or hydrogens.* | * ***Students need to already know that crude oil is found in the ground*** * ***Students need to already know that crude oil is a fossil fuel*** |  | *Tier 2*  *Finite: a resource that won’t naturally replenish*  *Tier 3*  *Biomass: matter from living organisms*  *Plankton: microscopic organisms found in the sea or fresh water*  *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** * *Students will know that crude oil can be separated in to the fractions using fractional distillation* * *Students will know that fractions can be processed to produce fuels and feedstock for the petrochemical industry.* * *Students will know that we use a lot of the products from fractions.* * *Students will know that fractional distillation works through evaporation and condensation.* * *Students will know that the different fractions are separated by their boiling points.* | ***Students need to already know that crude oil is a mixture of hydrocarbons.***  *Students need to already know that boiling is the change of state from liquid to gas*  *Students need to already know that condensation is the change of state from gas to liquid* | *Interpreting Data* | *Tier 2*  *Tier 3*  *Fractions: a group of molecules that have similar boiling points* |
| **Lesson:**  **Properties of Hydrocarbons** | * *Students will know that as hydrocarbons get longer, the boiling point increases* * *Students will know that as hydrocarbons get longer, the viscosity increases* * *Students will know that as hydrocarbons get longer, the flammability decreases.* * *Students will know that combustion is the reaction between hydrocarbons and oxygen, and releases a lot of energy.* * *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***  *Students need to already know that boiling point is the temperature a substance boils at* | *Interpreting data* | *Tier 2*  *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. * Student will know that the process of braking down the hydrocarbons is known as cracking. * Students will know that cracking can be done using catalytic cracking and steam cracking. * Students will know that catalytic cracking uses a temperature of around 550 oC and a zeolite catalyst. * Students will know that steam cracking uses a higher temperature of over 800 oC and no catalyst. * Students will know that cracking alkanes produces a shorter alkane and an alkene. * Students will know that alkenes are a type of hydrocarbon that contains a carbon carbon double bond. * Students will know that when bromine water is added to alkenes it decolourises (orange to colourless), but it doesn’t decolourise with alkanes. * Students will know that there is a high demand for fuels with small molecules. * Students will know how to write balanced equations for cracking. * Students will know how to explain the importance of cracking. | ***Students need to already know that hydrocarbons can have different lengths***  Students need to already know that hydrocarbons contain carbon and hydrogen | Interpreting and analysing data | Tier 2  Decolourise: Remove colour  Tier 3  Cracking: a method used to split long alkane molecules into smaller molecules (an alkane and an alkene)  Catalyst: A substance that speeds up a chemical reaction without itself being used up |
| **Lesson:**  **Reactions of Alkenes (TRIPLE ONLY)** | * Students will know that the reaction of functional groups of organic compounds determines the reactions of organic compounds. * Students will know that alkenes combust, but they tend to burn with smoky flames compared to alkanes. * Students will know that alkenes react with hydrogen, water and halogens. * Students will know that the reaction of alkenes are addition reactions, so that double bond becomes a single carbon-carbon bond. * Students will know how to draw the first 4 alkenes. * 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  Tier 3  Functional group: part of a molecule that determines how it reacts  Addition: reaction where groups are added to molecules |
| **Lesson:**  **Alcohols (TRIPLE ONLY)** | * Students will know that alcohols contain the function group -OH * Students will know that methanol, ethanol, propanol and butanol are the first four members of the alcohols * Students will know how to represent the first 4 alcohols. * Students will know that alcohols react with sodium, oxygen and oxidising agents. * Students will know how to represent the products of the reactions of alcohols. * 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  Tier 3  Oxidising agent: substance that will oxidise another substance  Fermentation: The chemical breakdown of a substance using yeast  Yeast: a microscopic fungus |
| **Lesson:**  **Carboxylic Acids (TRIPLE ONLY)** | * Students will know that carboxylic acids have the functional group -COOH * Students will know that the first four members of the carboxylic acids are methanoic acid, ethanoic acid, propanoic acid and butanoic acid. * Students will know how to represent carboxylic acids. * Students will know that carboxylic acids react with carbonates and alcohols * Students will know how to represent the products of reactions between carboxylic acids and carbonates and alcohols * 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  Tier 3  Weak acids: Acids that partially ionise |
| **Lesson: Addition Polymerisation (TRIPLE ONLY)** | * Students will know that alkenes are used to make polymers through addition polymerisation. * Students will know that in addition polymerisation many small molecules (monomers) join together to form very large molecules (polymers) * 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  Tier 3  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. * Students will know that when condensation polymerisation takes place small molecules (such as water) are lost. * Students will know that diols are compounds that contain two alcohol groups * Students will know that dioic acids are compounds that contain to carboxylic acid groups * 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  Tier 3  Diol: a molecule that contains 2 alcohol groups  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 * Students will know that amino acids react by condensation polymerisation to produce polypeptides. * Students will know that different amino acids can be combined in the same chain to produce proteins * Students will know how to represent condensation polymerisation of amino acids. | Students need to already know that amino acids make up protein |  | Tier 2  Tier 3  Polypeptide: Polymer formed when amino acids combine through condensation polymerisation |
| **Lesson: DNA and other polymers (TRIPLE ONLY)** | * Students will know that DNA is a large molecule. * Students will know that DNA molecules are made up of two polymer chains, from 4 different monomers called nucleotides * Students will know that examples of other naturally important polymers are cellulose, proteins and starch. * Students will know that the monomer of cellulose and starch is glucose * Students will know that the monomer of proteins is amino acids. | Students need to already know that DNA is a double helix |  | Tier 2  Tier 3  Cellulose: polymer that is found in plant cell walls  Starch: naturally occurring polymer found in plant leaves  Nucleotide: monomer of DNA, containing sugar, phosphate group and a base. |