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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 2Decolourise: Remove colourTier 3Cracking: 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 2Tier 3Functional group: part of a molecule that determines how it reactsAddition: 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 2Tier 3Oxidising agent: substance that will oxidise another substanceFermentation: The chemical breakdown of a substance using yeastYeast: 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 2Tier 3Weak 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 2Tier 3Monomer: 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 2Tier 3Diol: a molecule that contains 2 alcohol groupsDioic 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 2Tier 3Polypeptide: 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 2Tier 3Cellulose: polymer that is found in plant cell wallsStarch: naturally occurring polymer found in plant leavesNucleotide: monomer of DNA, containing sugar, phosphate group and a base. |