Medium Term Planning - Topic: Crude oil and fuels

Curriculum Intent	**In addition to working further on objectives from Year __, pupils will be taught, following National Curriculum guidelines, the following this topic:**
Skills/National Curriculum Links	Aiming for Grade 4 LOs: • Describe the composition of crude oil. • State a definition of a hydrocarbon. • State a definition of an alkane. Aiming for Grade 6 LOs: • Describe how to separate crude oil into fractions in a school laboratory. • Classify a hydrocarbon as an alkane. • State the names and describe the first four alkanes. Aiming for Grade 8 LOs: • Explain why fractional distillation is used to separate crude oil into fractions. • Apply a general formula to generate a molecular formula and a displayed formula for a straight-chain alkane. • Classify and justify the classification of a chemical as an alkane: Aiming for Grade 4 LOs: • Name the different fractions from crude oil. • State a use for each fraction from crude oil. Aiming for Grade 6 LOs: • Describe how the trend in colour, viscosity, flammability, and boiling point changes as the length of the hydrocarbon chain changes. • Describe how the properties of a fraction of crude oil make it appropriate for its use. Aiming for Grade 8 LOs: • Explain in detail how fractional distillation is used to separate crude oil into fractions. • Explain how chain length affects the properties of crude oil fractions. • Make predictions about the properties of crude oil fractions from the fraction's hydrocarbon chain length. Burning hydrocarbon fuels: Aiming for Grade 4 LOs: • Define complete and incomplete combustion. • Write a word equation to describe the complete combustion of a hydrocarbon. • Write a word equation to describe the incomplete combustion of a hydrocarbon. Aiming for Grade 6 LOs: • Explain the differences between complete and incomplete combustion. Write balanced symbol equations for the complete and incomplete combustion of • hydrocarbons. • Explain how to test for the products of complete combustion. Aiming for Grade 8 LOs: • Justify the use of a given fuel over another. • Explain in detail how the production of carbon monoxide in incomplete combustion can be lethal. • Use balanced symbol equations to calculate amounts of reactants or products in a combustion reaction. Cracking hydrocarbons: Aiming for Grade 4 LOs: • Define the process of cracking. • Generate a word equation to describe cracking. • Recognise and give examples of alkenes. Aiming for Grade 6 LOs: • Describe the process of cracking, including conditions. • Generate a balanced symbol equation to describe cracking. • Describe a chemical test to show an alkene is present. Aiming for Grade 8 LOs: • Use examples to explain the process of cracking and why it is so important to the petrochemical industry. • Explain the similarities and differences between alkanes and alkenes. • Explain, using balanced symbol equations, the reaction between bromine water and an alkene.
Spiritual, moral, social, and cultural development	**SMSC:** group work from practical activities in this section. Also pupils can work in groups to produce a timeline for the development of the periodic table. **PSHE/British Values:** The history of the is important development of the atom when learning about british values and world values. Students will complete teamwork, leadership and put science into everyday situations. They will show mutual respect during classwork. **Skills Builder:**Listening (Receiving, retaining and processing info), Speaking (The oral transmission of info and ideas), Problem solving (Find a solution to a situation or challenge), Creativity (imagination and

	generation of new ideas), Staying positive (The ability to use tactics and strategies to overcome setbacks), aiming high (Set clear and tangible goals), Leadership and teamwork
Numeracy	
Literacy	**Vocabulary Tier 2:** combustion, increases, decreases, chemically, continuous, refineries, odorless, vaporize. **Vocabulary Tier 3:** alkane, alkene, cracking, distillation, double bond, flammable, fraction, fractional distillation, general formula, hydrocarbon, mixture, oxidized, saturated hydrocarbon, thermal decomposition, unsaturated hydrocarbon, viscosity. **Reading:** Following a written method and read risk assessments. Students may be directed to the textbook; this could be in lesson or at home on Kerboodle. **Writing:** Describing and explaining scientific phenomenon, free response writing for describing precautions taken, use of word mat to promote sentence formation. **Oracy:** inclusion of BEST resources which are research evidence on common misunderstandings in science, effective diagnostic questioning and formative assessment, constructivist approaches to building understanding, and effective sequencing of key concepts that promote metacognitive talk and dialogue.
Becoming future ready	**Careers/Employability:** Scientist Chemist Drug development Teacher Post-doctoral researcher
Adaptation **QFT/SEND Provision**	Throughout this topic, quality first teaching will provide differentiation: **By product:** Linear assessments and differentiated practical work. **By resource:** Lessons are differentiated per class and students, worksheets are available if support and assessments are linear. **By Intervention**: by providing different levels of supervision and support **By Progressive Questioning:** exploring pupils' understanding through interactive dialogue. **By Grouping:** according to prior attainment, gender, social preference, preferred learning style. **By Offering Optional Activities:** In class or as homework, to extend learning. This QFT/SEND provision will be explicit within the lesson-by-lesson schemes of work.
Implementation Curriculum Delivery Learning Outcomes **(Core Knowledge)**	To be able to: 7.1.1 **Crude oil is a finite resource found in rocks**. Crude oil is the remains of an ancient biomass consisting mainly of plankton that was buried in mud. Crude oil is a mixture of a very large number of compounds. **Most of the compounds in crude oil are hydrocarbons, which are molecules made up of hydrogen and carbon atoms only.** Most of the hydrocarbons in crude oil are hydrocarbons called alkanes. The general formula for the homologous series of alkanes is CnH2n+2. **The first four members of the alkanes are methane, ethane, propane, and butane**. Students should be able to recognise substances as alkanes given their formulae in these forms. Students do not need to know the names of specific alkanes other than methane, ethane, propane, and butane. 7.1.2 The many **hydrocarbons in crude oil may be separated into fractions**, each of which contains molecules with a similar number of carbon atoms, by **evaporating the oil and allowing it to condense at different temperatures**. This process is called **fractional distillation**. The fractions can be processed to **produce fuels** and feedstock for the petrochemical industry. Many of the fuels on which we depend for our modern lifestyle such as **petrol, diesel oil, kerosene, heavy fuel oil, and liquefied petroleum gases**, are produced from crude oil. Many useful materials on which modern life depends are produced by the petrochemical industry, such as solvents, lubricants, polymers, detergents. The vast array of natural and synthetic carbon compounds occurs due to the ability of carbon atoms to form families of similar compounds. 7.1.3 Some properties of hydrocarbons depend on the **size of their molecules**, including boiling point, viscosity, and flammability. These properties influence how hydrocarbons are used as fuels. Students should be able to recall **how boiling point, viscosity, and flammability change with increasing molecular size**. Knowledge of trends in properties of hydrocarbons is limited to: • boiling points • viscosity • flammability. 7.1.3 The **combustion of hydrocarbo**n fuels releases energy. During combustion, the carbon and hydrogen in the fuels are oxidised. The **complete combustion** of a hydrocarbon produces carbon dioxide and water. Students should be able to write balanced equations for the complete combustion of hydrocarbons with a given formula. 7.1.4 Hydrocarbons can be broken down **(cracked) to produce smaller, more useful molecules**. Cracking can be done by various methods including catalytic cracking and steam cracking. Students should be able to describe in general terms the conditions used for catalytic cracking and steam cracking. The products of cracking include alkanes and another type of hydrocarbon called alkenes. Alkenes are more reactive than alkanes and **react with bromine water**, which is used as a test for alkenes. Students should be able to recall the **colour change when bromine water reacts with an alkene**. There is a high demand for fuels with small molecules and so some of the products of cracking are useful as fuels. Alkenes are used to produce polymers and as starting materials for the production of many other chemicals. Students should be able to balance chemical equations as examples of cracking given the formulae of the reactants and products.

	Students should be able to give examples to illustrate the usefulness of cracking. They should also be able to explain how modern life depends on the uses of hydrocarbons. (For combined science students do not need to know the formulae or names of individual alkenes.)
Current learning to be developed in the future within:	A level chemistry students will again in the organic topic in distillation of crude oil topic.
Assessment	Refer to assessment maps for formative and summative assessment opportunities.
Impact	Attainment and Progress – Refer to assessment results / data review documentation.