



Sequence	
TOPIC (S) ALKANES AND HALOALKANES	<ol style="list-style-type: none"> 1. Fractional distillation of crude oil 2. Modification of alkanes by cracking 3. Combustion of alkanes 4. Chlorination of alkanes 5. Nucleophilic substitution 6. Elimination 7. Ozone depletion
Knowledge & Skills development	<ul style="list-style-type: none"> • Know alkanes are saturated hydrocarbons. • Know petroleum is a mixture consisting mainly of alkane hydrocarbons that can be separated by fractional distillation. • Carry out fractional distillation of a crude oil substitute. • Know cracking involves breaking C–C bonds in alkanes. • Know thermal cracking takes place at high pressure and high temperature and produces a high percentage of alkenes (mechanism not required). • Know catalytic cracking takes place at a slight pressure, high temperature and in the presence of a zeolite catalyst and is used mainly to produce motor fuels and aromatic hydrocarbons (mechanism not required). • Explain the economic reasons for cracking alkanes. • Know alkanes are used as fuels. • Know combustion of alkanes and other organic compounds can be complete or incomplete. • Know the internal combustion engine produces a number of pollutants including NO_x, CO, carbon and unburned hydrocarbons. • Know these gaseous pollutants from internal combustion engines can be removed using catalytic converters. • Know combustion of hydrocarbons containing sulfur leads to sulfur dioxide that causes air pollution. • Explain why sulfur dioxide can be removed from flue gases using calcium oxide or calcium carbonate. • Know the reaction of methane with chlorine. • Explain this reaction as a free-radical substitution mechanism involving initiation, propagation and termination steps. •

- Know halogenoalkanes contain polar bonds.
- Know halogenoalkanes undergo substitution reactions with the nucleophiles OH⁻, CN⁻ and NH₃
- Outline the nucleophilic substitution mechanisms of these reactions
- Explain why the carbon–halogen bond enthalpy influences the rate of reaction.
- Follow instructions when carrying out test-tube hydrolysis of halogenoalkanes to show their relative rates of reaction.
- Prepare a chloroalkane, purifying the product using a separating funnel and distillation.
- Know the concurrent substitution and elimination reactions of a halogenoalkane (eg 2-bromopropane with potassium hydroxide).
- Explain the role of the reagent as both nucleophile and base
- Outline the mechanisms of these reactions.
- Know Ozone, formed naturally in the upper atmosphere, is beneficial because it absorbs ultraviolet radiation.
- Know chlorine atoms are formed in the upper atmosphere when ultraviolet radiation causes C–Cl bonds in chlorofluorocarbons (CFCs) to break.
- Know chlorine atoms catalyse the decomposition of ozone and contribute to the hole in the ozone layer.
- Appreciate that results of research by different groups in the scientific community provided evidence for legislation to ban the use of CFCs as solvents and refrigerants. Chemists have now developed alternative chlorine-free compounds.
- Use equations, such as the following, to explain how chlorine atoms catalyse decomposition of ozone: Cl• + O₃ → ClO• + O₂ and ClO• + O₃ → 2O₂ + Cl•

			<ul style="list-style-type: none"> Investigate the role of chemists in the introduction of legislation to ban the use of CFCs and in finding replacements.
Assessment / Feedback Opportunities	Exam questions – teacher assessed	Exam questions – self assessed	Extended writing task – teacher assessed Topic assessment
Cultural Capital	<ul style="list-style-type: none"> Invite Shell in to lecture about controlling air pollution 		
SMSC / Promoting British Values (Democracy, Liberty, Rule of Law, Tolerance & Respect)	<ul style="list-style-type: none"> Questionnaire investigating public attitude about global warming and air pollution through human activities Use of CFC's in history and the balance of industrial growth vs environmental impact 		
Reading opportunities	<ul style="list-style-type: none"> Recommended Read: https://www.acs.org/content/acs/en/education/whatischemistry/landmarks/cfcs-ozone.html Stratospheric ozone depletion, Larry Parker 		
Key Vocabulary	Alkanes, saturated, catalytic cracking, fractional distillation, combustion, free radical substitution, nucleophilic substitution, haloalkanes, nucleophile, ozone, chlorofluorocarbons, Independent Variable, Dependent Variable, Control Variables, Method, Conclusion, Precaution, Evaluation, Reliable, Precision, Valid, Anomaly, Describe, Explain, Compare, Analyse, Calculate, Suggest, Absolute, Uncertainty, Error		
Digital Literacy	The use of excel to plot graphs and analyse data MSOffice35 apps including SharePoint		
Cross-Curricular Links	Numeracy/Maths – averages (means), reading scales, graph plotting, lines of best fit, using and rearranging equations, using scientific calculators Geography – global warming Sociology – impact of human activities Engineering – catalytic converters and flue manufacture		
Careers	Hazardous waste specialist, historian, chemist, car engineer		