Units 3 & 4 Chemistry

Unit 3: How can design and innovation help to optimise chemical processes?

In this unit, students explore energy and material production in light of global population growth. They apply innovation, design, and sustainability principles to mitigate environmental and health impacts. Topics include analysing various fuels, studying energy transformations, assessing cell suitability for societal needs, and evaluating chemical processes to optimise reaction rates and minimise by-products. Practical activities cover thermochemistry, redox reactions, and electrochemical systems.

Area of study 1: What are the current and future options for supplying energy?

- Compare fuels quantitatively based on combustion products and energy outputs
- Apply knowledge of the electrochemical series to design, construct, and test primary cells and fuel cells
- Evaluate the sustainability of electrochemical cells in producing energy for society

Area of Study 2: How can the rate and yield of chemical reactions be optimised?

- Experimentally analyse chemical systems to predict optimisation of reaction rate and extent
- Explain the involvement of electrolysis in chemical production
- Evaluate the sustainability of electrolytic processes in producing materials for society.

Unit 4: How are carbon-based compounds designed for purpose?

In this unit, students explore the structures and reactions of carbon-based compounds, considering green chemistry principles. They study food metabolism and medication effects, with hands-on experiments in organic compound synthesis and analysis. Throughout, they use chemistry tools to interpret data and conduct a scientific investigation, presenting their findings in a poster format.

Area of Study 1: How are organic compounds categorised and synthesised?

- Analyse the general structures and reactions of major organic compound families
- Design reaction pathways for organic synthesis
- Evaluate the sustainability of organic compound manufacture in society

Area of Study 2: How are organic compounds analysed and used?

- Apply qualitative and quantitative tests to analyse organic compounds and their structural characteristics
- Deduce structures of organic compounds using instrumental analysis data
- Explain the functionality of certain medicines
- Experimentally analyse the extraction and purification of natural medicines

Area of Study 3: How is scientific inquiry used to investigate the sustainable production of energy and/or materials?

- Design and conduct a scientific investigation related to energy or chemical production, or organic compound analysis/synthesis
- Present the aim, methodology, method, results, discussion, and conclusion in a scientific poster format