Government of **Western Australia**
School Curriculum and Standards Authority

Chemistry General Course Year 12

Selected Unit 3 syllabus content for the

Externally set task 2020

This document is an extract from the *Chemistry General Course Year 12 syllabus*, featuring all of the content for Unit 3. The content that has been highlighted in the document is the content on which the Externally set task (EST) for 2020 will be based.

All students enrolled in the course are required to complete an EST. The EST is an assessment task which is set by the Authority and distributed to schools for administering to students. The EST will be administered in schools during Term 2, 2020 under standard test conditions. The EST will take 50 minutes.

The EST will be marked by teachers in each school using a marking key provided by the Authority. The EST is included in the assessment table in the syllabus as a separate assessment type with a weighting of 15% for the pair of units.

Unit 3

Unit description

In this unit, students further investigate the role that chemistry plays in their daily lives. They begin by investigating the naturally occurring, smelly, yellow-to-black liquid consisting of a complex mixture of hydrocarbons of various molecular weights, and other liquid organic compounds, that is crude oil. They examine its composition and the chemistry of some of the compounds that comprise it. This leads to an investigation of other oils, their sources, properties and uses, and finally, they consider the constituents, properties and uses of polymers.

Students appreciate the role of chemistry in contributing to a sustainable future by investigating recycling and disposal of community chemical wastes. They investigate ways that chemists assist in protecting the natural environment, such as by producing biodegradable alternatives, and by conservation and management of our resources. They recognise and acknowledge that the use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences.

Suggested contexts

The suggested context for the teaching of concepts within Unit 3 is carbon chemistry.

Unit content

It is recommended that students studying Unit 3 have completed a review of the following Unit 1 content:

- the language of chemistry
- the differences between elements, compounds and mixtures.

This unit includes the knowledge, understandings and skills described below.

Science Inquiry Skills

- construct questions for investigation; propose hypotheses; and predict possible outcomes
- plan investigations, including the procedure(s) to be followed, the materials required, and the type and amount of data to be collected; assess risk and address ethical issues associated with these methods
- conduct investigations, appropriate to the chosen context(s), safely, competently and methodically for the collection of reliable data, including the chemical identification of saturated and unsaturated compounds and the production and testing of a simple polymer, for example, casein glue or slime or similar
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error and inconsistencies in data; and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate the conclusions by considering the quality of available evidence
- construct and use appropriate representations, to communicate conceptual understanding, solve problems and make predictions

- communicate scientific ideas and information for a specific purpose using appropriate language, nomenclature and formats, including scientific reports

Science as a Human Endeavour

- most hydrocarbon fuels produced from crude oil also contain sulfur. When a fuel burns in air, gases, such as carbon dioxide, sulfur dioxide and oxides of nitrogen, are released into the atmosphere. Solid particles may also be released. The burning of hydrocarbon fuels contributes to acid rain, global warming and global dimming. Technology has been developed to chemically remove sulfur dioxide from waste gases after combustion in power plants and international cooperation has resulted in industrialised countries reducing emissions of greenhouse gases, such as carbon dioxide
- biofuels, such as biodiesel and ethanol, are produced from plant material. The production of biofuels is sustainable and biofuels produce fewer pollutants than hydrocarbon fuels made from crude oil. There are economic, ethical and environmental issues surrounding the use of biofuels, for example, using cropland to grow crops for fuel rather than for food may have an impact on the cost of food or lead to food shortages
- many polymers are not biodegradable. Non-biodegradability can lead to problems with waste disposal and recycling. Some products, such as plastic bags, packaging and disposable cutlery, are being made from a combination of polymers and other additives, such as starch, so that they break down more easily. The use of these products may provide benefits, such as reduced green-house gas emissions and reduced use of crude oil substances. The benefits need to be offset against any increased costs in production

Science Understanding

Crude oil

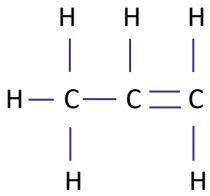
- crude oil is a mixture of a very large number of compounds
- the substances in crude oil can be separated using fractional distillation
- crude oil is made up of hydrocarbons; hydrocarbons consist of only hydrogen and carbon atoms
- most of the hydrocarbons found in crude oil are called alkanes; alkanes are hydrocarbons that contain only single carbon to carbon bonds and are described as saturated
- alkanes can be named using IUPAC conventions (C_1 –C_8, straight chain only)
- alkanes can be represented using structural formula (C_1 –C_8, straight chain only) for example, propane (C_3H_8)

Please note: for teaching purposes, in structural formulae ‘ —— ‘ should be described as a chemical bond.

- some properties of hydrocarbons, for example, boiling point and viscosity, depend on the number of atoms in the hydrocarbon; these properties influence how hydrocarbons are used as fuels and lubricants

Other substances from crude oil

- substances separated from the fractional distillation of crude oil can be broken down (cracked) to make smaller hydrocarbons, such as alkenes
- alkenes are hydrocarbons that contain at least one carbon to carbon double bond and are described as unsaturated
- alkenes can be named using IUPAC conventions (C_2-C_3 only)
- alkenes can be represented using structural formulae (one double bond), for example, propene (C_3H_6)



Polymers

- alkenes can be used to make very large molecules called polymers, for example, polyethene and polypropene and polystyrene
- many small molecules, called monomers, are joined together to form polymers
- polymers have many useful applications, for example, plastics, water saving hydrogels, encapsulated microbes, and waterproof coatings for fabrics
- information on plastic packaging identifies the type of plastic and recycling process used

Vegetable oils

- some fruits, seeds and nuts are rich in oils that can be extracted
- vegetable oils are important foods and fuels as they provide a lot of energy
- oils are insoluble in water; oils can be used to produce emulsions, for example, in food and cosmetics
- vegetable oils that are unsaturated contain double carbon to carbon chemical bonds; these can be distinguished using bromine water or a dilute solution of iodine in ethanol

Biofuels

- vegetable oils can be used to make biofuels
- ethanol is an alcohol with the formula CH_3CH_2OH
- ethanol can be used as a biofuel
- ethanol can be produced by fermentation