



SAMPLE COURSE OUTLINE

CHEMISTRY
GENERAL YEAR 12

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Sample course outline

Chemistry – General Year 12

Unit 3 and Unit 4

Science Inquiry Skills

Science Inquiry Skills align with the Science Understanding and Science as a Human Endeavour content of the unit and are integrated into the learning experiences.

- 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

Semester 1

Week	Syllabus content
1	Structure of the syllabus <ul style="list-style-type: none"> • course outline • assessment outline Crude oil <ul style="list-style-type: none"> • crude oil is a mixture of a very large number of compounds • crude oil is made up of hydrocarbons; hydrocarbons consist of only hydrogen and carbon atoms • the substances in crude oil can be separated using fractional distillation
2–3	Crude oil <ul style="list-style-type: none"> • 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) • 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 • 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 (SHE) Task 1: Practical – Properties of hydrocarbons Task 2: Extended response – Comparing biofuels and hydrocarbon fuels from crude oil

Week	Syllabus content
4–5	<p>Other substances from crude oil</p> <ul style="list-style-type: none"> 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 (C₂–C₃ only) alkenes can be represented using structural formulae (one double bond); for example, propene (C₃H₆) <p>Task 3: Test – Crude oil</p>
6–8	<p>Polymers</p> <ul style="list-style-type: none"> 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 many polymers are not biodegradable. Non-biodegradability can lead to problems with waste disposal and recycling (SHE)
9–12	<p>Vegetable oils</p> <ul style="list-style-type: none"> 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 <p>Task 4: Practical – Identifying saturated and unsaturated vegetable oils Task 5: Test – Polymers and vegetable oils</p>
13–15	<p>Biofuels</p> <ul style="list-style-type: none"> biofuels 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 (SHE) vegetable oils can be used to make biofuels ethanol is an alcohol with the formula CH₃CH₂OH ethanol can be used as a biofuel ethanol can be produced by fermentation <p>Task 6: Investigation – Energy content of biofuels Task 7: Externally set task</p>

Semester 2 – Context – Materials Chemistry

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Week	Syllabus content
1–4	<p>Metal properties and structure</p> <ul style="list-style-type: none"> • metals can be distinguished from non-metals by their physical and chemical properties • metals and non-metals can be identified by their position on the periodic table • metals consist of giant structures of atoms arranged in a regular pattern • the layers of atoms in metals are able to slide over each other, so metals can be bent and shaped • metals have a range of melting points and relatively high boiling points • different metals have different abilities to conduct heat and electricity • conductivity depends on the ability of electrons to move throughout the metal • electrical conductivity can be measured using a simple circuit or one which could include an ammeter or a multimeter • the properties of metals determine how they are used; for example, copper is useful for electrical wiring and plumbing • flame tests can be used to identify metals • transition metals form coloured compounds; this enables them to be used for many purposes; for example, paint pigments, coloured glass and ceramics • Aboriginal Peoples mined a variety of ochres, which contained mixtures of hydrated oxides of iron (SHE) <p>Task 8: Investigation – Comparing heat conduction of different metals</p>
5–6	<p>Alloys</p> <ul style="list-style-type: none"> • metals can form mixtures with other metals and substances like carbon to make alloys; for example, stainless steel • alloys have different physical properties when compared to pure metals; this can increase the range of purposes that an alloy is suitable for • shape memory alloys (SMAs) are metals that can return to their original shape after being deformed. This allows them to be used as actuators in many applications (SHE) <p>Task 9: Test – Metal properties and structure and Alloys</p>
7–9	<p>Metal reactions</p> <ul style="list-style-type: none"> • observations, word equations and simple chemical equations for the following chemical reaction types <ul style="list-style-type: none"> ▪ acid-metal ▪ metal carbonate decomposition ▪ simple metal displacement ▪ metal/metal ion displacement reactions can be used to investigate differences in metal reactivity <p>Task 10: Practical – Metal/metal ion investigation Task 11: Test – Metal reactions</p>

Week	Syllabus content
10–12	<p>Metal extraction</p> <ul style="list-style-type: none">the extraction of metals from ores involves the use of limited resources and is expensive in terms of energy and effects on the environment (SHE)unreactive metals; for example gold, are found in the Earth as the metal itself, but most metals are found as compoundscopper can be extracted from oresthe percentage of metal in an ore can be calculated from the mass of the metal in the ore and the mass of the ore samplecopper can be obtained from solution by electrolysis, or by displacement using iron <p>Task 12: Extended response – Extraction and refining of copper</p>
13–15	<p>Metal corrosion</p> <ul style="list-style-type: none">almost all engineering materials are subject to corrosion. Due to the economic costs involved, corrosion research groups collaborate to develop new treatment methods and structural design features to reduce the amount of corrosion (SHE)corrosion is the gradual break down of materials by chemical reaction with the environmentcorrosion occurs when metals react with oxygen to form metal oxides; for example, aluminium and ironwhen aluminium reacts with oxygen, the resulting aluminium oxide forms a tough coating that protects the metal underneath from further contact with oxygenwhen iron reacts with oxygen and water, it forms a corrosion product called rust. Rust on the surface of the iron is porous, allowing the metal underneath to come into further contact with oxygen and waterthe rate of corrosion of iron can be influenced by a number of factors; for example, moisture and impuritiesthe rate of corrosion of iron can be slowed down when it is alloyed with other metals, in contact with a more reactive metal, or when it has a protective coating <p>Task 13: Practical – Factors influencing the rate of corrosion</p> <p>Task 14: Test – Metal extraction and Metal corrosion</p>

Semester 2 – Context – Biochemistry

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1–4	<p>Proteins</p> <ul style="list-style-type: none"> • proteins are large molecules (polymers) made up from smaller molecules (monomers) called amino acids • amino acids consist mainly of carbon, hydrogen and nitrogen atoms and sometimes sulfur atoms • there are many different types of proteins that carry out different functions • performance enhancing drugs, for example, a protein hormone, erythropoietin (EPO), can increase oxygen delivery to the muscles, improving their endurance capacity. The use of banned performance enhancing drugs in sports provides an unfair advantage. Their use can result in health complications, for example, stroke. The decision by athletes to take performance enhancing drugs may be influenced by social, economic, ethical and political considerations (SHE) <p>Task 8: Practical – Precipitation of the milk protein casein and its enzyme treatment</p>
5–7	<p>Carbohydrates</p> <ul style="list-style-type: none"> • carbohydrates consist of carbon, hydrogen and oxygen atoms • carbohydrates are stored as glycogen in the muscles and liver • glycogen is a large molecule (polymer) made up from smaller molecules (monomers) of glucose • glucose is the main source of energy in the diet, in preference to fats and proteins • in people with diabetes, insulin (a protein hormone) is no longer produced or not produced in sufficient amounts by the pancreas. Insulin helps convert glucose in the blood into glycogen for storage in the liver and muscles. Diabetics monitor their blood glucose levels to ensure they are not too high. Blood glucose monitoring involves diabetics pricking their finger to obtain a blood sample. Emerging technologies help calculate insulin dosage. Non-invasive products, such as ring-shaped probes which are placed on the outside of the finger, help diabetics to monitor their glucose levels (SHE) <p>Task 9: Test – Proteins and Carbohydrates</p>
8–11	<p>During exercise</p> <ul style="list-style-type: none"> • glycogen is broken down to form glucose • cellular respiration is a chemical reaction that takes place in the cells of the body to produce energy. Cells use adenosine triphosphate (ATP) from glucose and oxygen to supply their energy

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	<p>needs</p> <ul style="list-style-type: none"> cellular respiration requires oxygen to generate ATP and is also called 'aerobic respiration' cellular respiration can be represented using a simple word equation exercise that involves short bursts of speed and power; for example, sprinting, involves anaerobic respiration anaerobic respiration produces ATP from the breakdown of glucose without the presence of oxygen lactic acid is produced by anaerobic respiration and accumulates in muscle cells. This causes a decrease in the pH of the muscle cells, leading to an impairment of muscle contractions <p>Task 10: Extended response – Role of glycogen in the body Task 11: Practical – Comparing aerobic and anaerobic respiration Task 12: Test – During exercise – Cellular energy production and respiration</p>
12–15	<p>During exercise</p> <ul style="list-style-type: none"> muscles are made up of multiple bundles of muscle fibres (cells) held together by connective tissue skeletal muscle fibres can be classified into two broad categories, Type I and Type II Type I muscle fibres appear red due to the presence of a protein (myoglobin) which binds oxygen; Type II muscle fibres appear white as they lack this protein ATP is used up when muscles move and contract endurance exercise uses mainly Type I muscle fibres and involves aerobic respiration exercise that involves short bursts of speed and power; for example, sprinting, uses mainly Type II muscle fibres ions (electrolytes) must be present in appropriate concentrations to maintain muscle contraction and fluid balance sweating causes loss of water which can lead to dehydration and the excretion of ions (electrolytes); for example, sodium, potassium, magnesium and chloride ions sports drinks and diet supplements are formulated using a knowledge of biochemistry. The composition and form of sports drinks and diet supplements is changed by manufacturers in response to new scientific information becoming available, as well as in response to social, economic and ethical considerations (SHE) a knowledge of the chemical reactions that occur in the human body is used in the field of pathology. Body fluid samples can be analysed for a range of chemical substances. If the concentration of the chemical substance being analysed is not within the normal range, it may indicate that a particular organ, for example the liver or kidney, is not functioning correctly, or that disease is present (SHE) <p>Task 13: Investigation – Muscle fatigue Task 14: Test – During exercise – Muscles and role of ions (electrolytes)</p>