Erindale College

Assessment Period:	**2021 S2**
Course:	**CHEMISTRY**
Unit:	**Unit 4: Structure, Synthesis and Design (1.0)**
Accreditation:	**T**
Year:	**12**

Unit Goals

- understand how the presence of functional groups and the molecular structure of organic compounds are related to their properties
- understand addition, condensation and oxidation reactions, and predict the products of these reactions
- understand how knowledge of chemical systems is used to design synthesis processes, and how data from analytical techniques provides information about chemical structure
- understand how models and theories have developed over time and the ways in which chemical knowledge interacts with social, economic, cultural and ethical considerations in a range of contexts
- use science inquiry skills to design, conduct, evaluate and communicate investigations into reactions and the identification of organic compounds, including analysis of secondary data derived from chemical analysis
- evaluate, with reference to empirical evidence, claims about organic synthesis and chemical design, and justify evaluations
- communicate, predict and explain chemical phenomena using qualitative and quantitative representations in appropriate modes and genres

Content Description

Science Inquiry Skills

- identify, research, construct and refine questions for investigation; propose hypotheses; and predict possible outcomes
- design investigations, including the procedure/s to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics
- conduct investigations, including using organic synthesis methods and collating data from chemical analyses, safely, competently and methodically for the collection of valid and reliable data
- represent data in meaningful and useful ways, including using appropriate graphic representations and correct units and symbols; organise and analyse data to identify patterns and relationships; identify and distinguish between random and systematic errors, and estimate their effect on measured results; discuss how the nature of the procedure and the sample size may influence uncertainty and limitations in data; and select, synthesise and use evidence from a range of sources to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments
- select, construct and use appropriate representations, including physical, virtual and graphical models of primary, secondary and tertiary structures, structural formulas, chemical equations, systematic nomenclature (using IUPAC conventions) and spectra, to communicate conceptual understanding, solve problems and make predictions
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- select and use appropriate mathematical representations to solve problems and make predictions, including using the mole concept to calculate quantities in chemical reactions, including multi-step reactions, and the percentage yield of synthesis reactions
- communicate to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports

Science as a Human Endeavour

- ICT and other technologies have dramatically increased the size, accuracy and geographic
- temporal scope of data sets with which scientists work
- models and theories are contested and refined or replaced when new evidence challenges them, or when a new model or theory has greater explanatory power
- the acceptance of scientific knowledge can be influenced by the social, economic and cultural context in which it is considered
- people can use scientific knowledge to inform the monitoring, assessment and evaluation of risk
- science can be limited in its ability to provide definitive answers to public debate; there may be insufficient reliable data available, or interpretation of the data may be open to question
- international collaboration is often required when investing in large-scale science projects or addressing issues for the Asia-Pacific region
- scientific knowledge can be used to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability

Science Understanding - Properties and structure of organic materials

- organic molecules have a hydrocarbon skeleton and can contain functional groups, including alcohols, carboxylic acids, esters, amines and amides
- each class of organic compounds displays characteristic chemical properties and undergoes specific reactions based on the functional groups present; these reactions, including acid-base and oxidation reactions, can be used to identify the class of the organic compound
- organic materials including proteins, carbohydrates and synthetic polymers display properties including strength, density and biodegradability that can be explained by considering the primary, secondary or tertiary structures of the material
- data from analytical techniques, including mass spectrometry, x-ray crystallography and infrared spectroscopy, can be used to determine the structure of organic molecules, often using evidence from more than one technique

Science Understanding - Chemical synthesis and design

- chemical synthesis involves the selection of particular reagents to form a product with specific properties (for example, pharmaceuticals, fuels, cosmetics, cleaning products)
- designing chemical synthesis processes involves constructing reaction pathways that may include more than one chemical reaction
- designing chemical synthesis processes includes identifying reagents and reaction conditions in order to maximise yield and purity of product
- the yield of a chemical synthesis reaction can be calculated by comparing stoichiometric quantities with actual quantities
- green chemistry principles include the design of chemical synthesis processes that use renewable raw materials, limit the use of potentially harmful solvents and minimise the amount of unwanted products
- organic molecules, including polymers, can be synthesised using addition and condensation reactions
- fuels (for example, biodiesel, ethanol, hydrogen) can be synthesised from organic or inorganic sources using a range of chemical reactions including addition, oxidation and esterification
- molecular manufacturing processes, including protein synthesis, involve the positioning of molecules

to facilitate a specific chemical reaction; such methods have the potential to synthesise specialised products (for example, carbon nanotubes, nanorobots, chemical sensors used in medicine)

Assessment Tasks

Name	Due Date	Weighting
Assignment 1	9 August - 13 August	20%
Exam 1	3 September - 8 September	30%
Exam 2	17 November - 19 November	30%
Assignment 2	8 November - 12 November	20%

School Assessment Information

For penalties for late and non-submission of work
See BSSS Policy and Procedure Manual 4.3.10 for further information.

For academic integrity
See BSSS Policy and Procedure Manual 4.3.12 for further information.

For appeals processes
See BSSS Policy and Procedure Manual 7.2 for further information.

For moderation procedures (internal and external)
See BSSS Policy and Procedure Manual 5 for further information.

For meshing procedures
See BSSS Policy and Procedure Manual 5.4.1 for further information.

For method of unit score calculation
See BSSS Policy and Procedure Manual 4.3.6.2 for further information.

For procedures for calculating course scores
See BSSS Policy and Procedure Manual 4.3.13.2 for further information.

Achievement Standards for CHEMISTRY T - Year 12

	*A student who achieves an **A** grade typically*	*A student who achieves a **B** grade typically*	*A student who achieves a **C** grade typically*	*A student who achieves a **D** grade typically*	*A student who achieves an **E** grade typically*
Concepts, Models & Applications	• critically analyses the properties and functions of system components, processes and interactions, and the interplay and effects of factors across a range of scales • evaluates applications, limitations, and predictions of theories and models to explain systems and create solutions, with evidence, in unfamiliar contexts • evaluates evidence with reference to critical analysis of models and/or theories, and develops evidence-based conclusions and evaluates limitations	• analyses the properties and functions of system components, processes and interactions, and the interplay and effects of factors across a range of scales • analyses applications, limitations, and predictions of theories and models to explain systems and create plausible solutions, with evidence in familiar contexts • analyses evidence with reference to models and/or theories, and develops evidence-based conclusions and discusses limitations	• explains the fundamental properties and functions of system components, processes and interactions, and the effects of factors across a range of scales • explains applications, limitations, and predictions of theories and models to explain systems and create plausible solutions in familiar contexts • describes evidence with reference to models and/or theories, and develops evidence-based conclusions and identifies limitations	• describes the fundamental properties and functions of system components, processes and interactions, and the effects of one or more factors • describes the nature, functions, limitations and applications of theories and models to create solutions to problems with supporting evidence • describes evidence, and develops conclusions with some reference to models and/or theories	• identifies the fundamental properties and functions of system components, processes and interactions, and some affective factors • identifies the nature, functions, limitations and applications of theories and models, and suggest solutions to problems with supporting evidence • identifies evidence, and asserts conclusions with little or no reference to models and/or theories
Contexts	• critically analyses epistemology, role of peer review, collaboration, and technology in developing knowledge • critically analyses the influence of social, economic, ethical and cultural factors on Science	• analyses epistemology, role of peer review and technology in developing knowledge • analyses the influence of social, economic, ethical and cultural factors on Science	• explains epistemology, role of peer review and technology in developing knowledge • explains the influence of social, economic, ethical and cultural factors on Science	• describes role of peer review and technology in developing knowledge • describes the influence of social, economic, ethical and cultural factors on Science	• identifies that scientific knowledge has changed over time • identifies the influence of social, economic, ethical and cultural factors on Science
Inquiry Skills	• designs, conducts and improves safe, ethical and original inquiries individually and collaboratively, that collect valid, reliable data in response to a complex question • critically analyses cause and correlation, anomalies, reliability and validity of data and representations, and critically analyses errors • evaluates processes and claims, and provides a critique based on evidence, and critically analyses alternatives • reflects on own thinking and evaluates planning, time management, use of appropriate work strategies • communicates concisely, effectively and accurately, with scientific literacy in a range of modes, representations, and genres for specific audiences and purposes, and accurate referencing	• designs, conducts and improves safe, ethical inquiries individually and collaboratively, that collect valid, reliable data in response to a question • analyses cause and correlation, anomalies, reliability and validity of data and representations, and analyses errors • explains processes and claims, and provides a critique with reference to evidence, and analyses alternatives • reflects on their own thinking and analyses planning, time management, use of appropriate work strategies • communicates clearly and accurately, with scientific literacy in a range of modes, representations and genres for specific audiences and purposes, and accurate referencing	• plans and conducts safe, ethical inquiries individually and collaboratively, that collect valid data in response to a familiar question • describes causal and correlational relationships, anomalies, reliability and validity of data and representations, and discusses common errors • describes processes and claims, and identifies alternatives with reference to reliable evidence • reflects on their own thinking and explains planning, time management, use of appropriate work strategies • communicates accurately demonstrating scientific literacy, in a range of modes, representations, and genres for specific purposes, and mostly consistent referencing	• follows a procedure to conduct safe, ethical inquiries individually and collaboratively, to collect data in response to a simple question with varying success • describes trends, relationships and anomalies in data, identifies anomalies, and cites sources of error • describes processes and claims, and identifies the need for improvements with some reference to evidence • reflects on their own thinking, with reference to planning and the use of appropriate work strategies • communicates demonstrating some scientific literacy, in a range of modes, representations, and genres with some evidence and inconsistent referencing	• follows a procedure to conduct safe, ethical inquiries individually and collaboratively, to collect data with little or no connection to a question • identifies trends and relationships in data with reference to sources of error • identifies processes and the need for some improvements, with little or no reference to evidence • reflects on their own thinking with little or no reference to planning, time management, and use of work strategies • communicates demonstrating limited scientific literacy, in a range of modes and representations, with inconsistent and inaccurate referencing