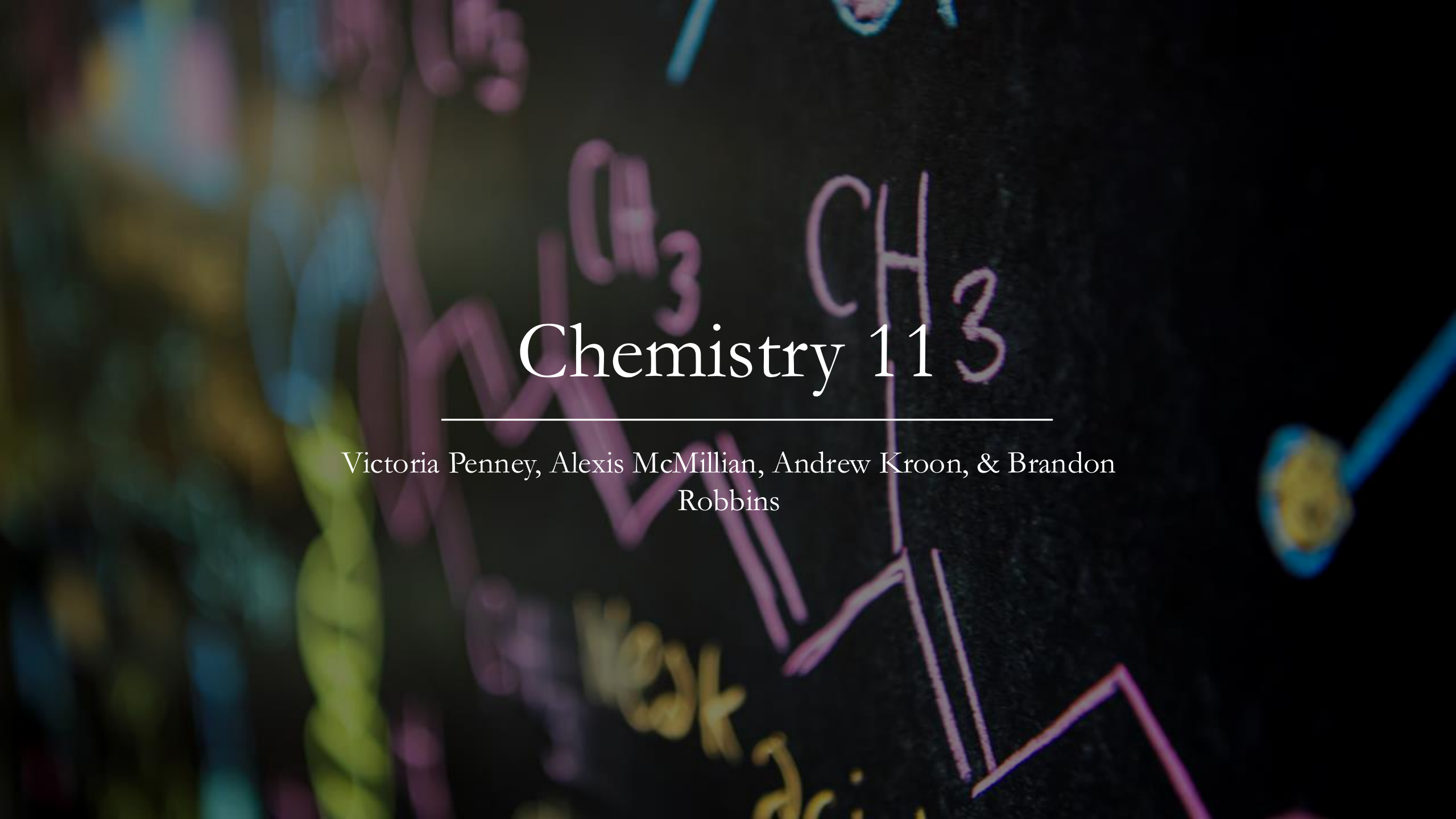


Chemistry 11

Victoria Penney, Alexis McMillian, Andrew Kroon, & Brandon Robbins

General Curriculum Outcomes

STSE (Science, Technology, Society, and the Environment): Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

Skills: Students will develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively, and for making informed decisions.

Knowledge: Students will construct knowledge and understandings of concepts in life science, physical science, and Earth and space science, and apply these understandings to interpret, integrate, and extend their knowledge.

Attitudes: Students will be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society, and the environment.

Unit Overviews

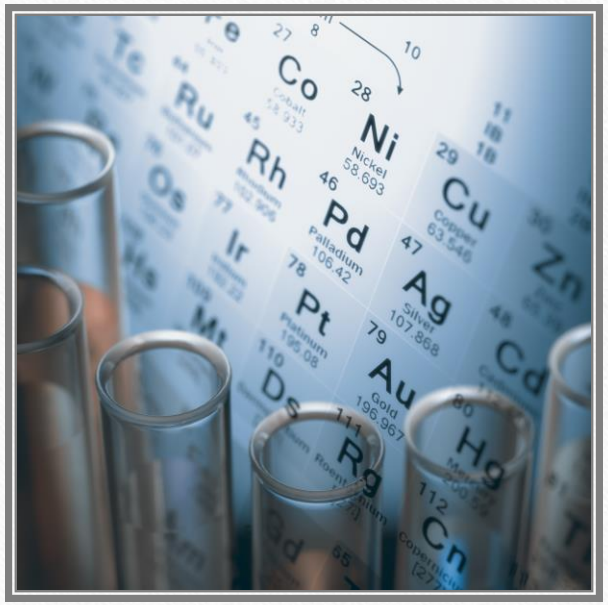
STOICHIOMETRY (39%)

FROM STRUCTURES TO PROPERTIES (28%)

ORGANIC CHEMISTRY (33%)

Unit 1: Stoichiometry (39%)

- A quantitative relationship between the reactants and products in a chemical reaction
- Calculating the amounts of each substance that is involved in a reaction using the mole-to-mole ratio in a chemical equation
- Determines the ratio of reactants needed to complete the amount of products produced



Specific Curriculum Outcomes

Subtopic 1: The Mole and Molar Mass

- Define molar mass and perform mole-mass inter-conversions for pure substances (323-1)
- Explain how a major scientific milestone, the mole, changed chemistry (115-3)

Subtopic 2: Calculations and Chemical Equations

- Identify mole ratios of reactants and products from balanced chemical equations (323-10)
- Identify practical problems that involve technology where equations are used (214-13)
- State a prediction and hypothesis based on available evidence and background information (212-4)
- Perform stoichiometric calculations related to chemical equations (323-11)

Specific Curriculum Outcomes

Subtopic 3: Stoichiometric Experimentation

- Design stoichiometric experiments identifying and controlling major variables (212-3)
- Use instruments effectively and accurately for collecting data (213-3)
- Identify and explain sources of error and uncertainty in measurement using precision and accuracy (214-10)
- Communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others (215-1)
- Identify various constraints that result in trade-offs during the development and improvement of technologies (114-4)

Subtopic 4: Applications of Stoichiometry

- Identify various stoichiometric applications (323-12)
- Predict how the yield of a particular chemical process can be maximized (323-13)
- Explain how data support or refute the hypothesis or prediction of chemical reactions (214-12)
- Compare processes used in science with those used in technology (114-7)
- Analyze society's influence on science and technology (117-2)

Connections to the Real World – Lab/Tech Ideas

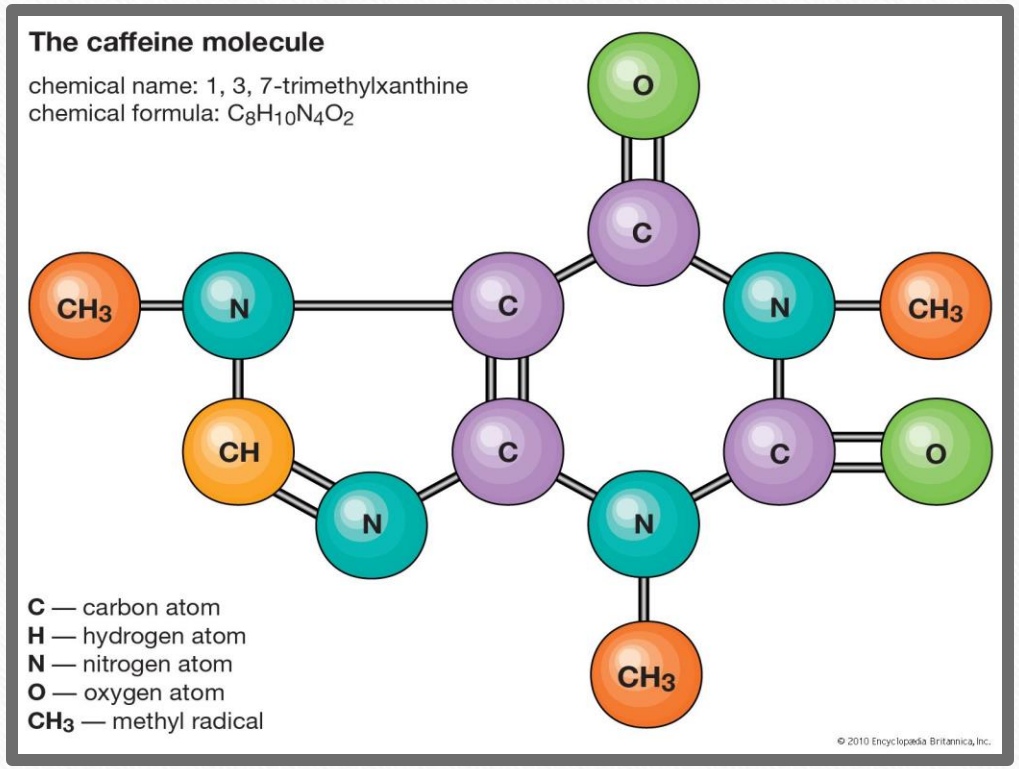
Objective: Learn laboratory setting and equipment. Accurately and effectively collect data in lab settings including percent yield. Explain sources of uncertainty and error in measurements. Design stoichiometry experiments.

Experiment: S'more Stoichiometry

Equipment: Graham Crackers, Marshmallows, Chocolate, Bunsen Burner, paper towel

Design: Students are given a worksheet containing questions about Stoichiometry. They are to answer questions on the worksheet which practice Stoichiometry balancing and product calculations. After this has been completed, students are allowed to make their own s'mores!

Unit 2: From Structures to Properties (28%)



- All matter is held together by chemical bonds
- Different types of chemical bonds are influenced by different attractive forces.
- Structural arrangements and bond energies impact various chemical properties

Specific Curriculum Outcomes

Subtopic 1 – Properties of Ionic and Molecular Compounds and Metallic Substances

- Select and integrate information from various print and electronic sources or from several parts of the same source
- Identify and describe the properties of ionic and molecular compounds and metallic substances

Subtopic 2 – Classifying Compounds

- Classify ionic, molecular, and metallic substances according to their properties
- Identify consumer products and investigate the claims made by companies about the products

Subtopic 3 – Bonding

- Illustrate and explain the formation of ionic, covalent, and metallic bonds

Specific Curriculum Outcomes

Subtopic 4 – Structural Models of Bonding

- Explain the structural model of a substance in terms of the various bonds that define it
- Explain how knowledge of bonding evolves as new evidence and theories are tested and subsequently revised or replaced
- Analyse examples of Canadian contributions to bonding
- Analyse and describe examples where technologies were developed based on bonding
- Form a variety of perspectives, analyse the risks and benefits to society and the environment of applying bonding knowledge or introducing a particular technology

Specific Curriculum Outcomes

Subtopic 5 – Bond Energies

- Identify limitations of categorizing bond types based on differences in electronegativity between the elements and compounds
- Explain the evidence from a bonding experiment and from the collected data in the development of bond energies
- Describe how the different types of bonds account for the properties of ionic and molecular compounds and metallic substances

Subtopic 6 – Polar and Pure Covalent Bonding

- Illustrate and explain hydrogen bonds and van der Waals' forces
- Use library and electronic research tools to collect bonding information
- Select and integrate information from various print and electronic sources or from several parts of the same source
- By hand or computer, compile and display evidence and information in a variety of formats, including diagrams, flow charts, tables, and graphs

Connections to the Real World – Lab/Tech Ideas

Objective: Demonstrate the difference between Ionic and Molecular compounds using physical lab tests. Specifically, targeting the solubility of Ionic and Molecular compounds in a polar solvent (water). Further testing can be done to illustrate the different melting points.

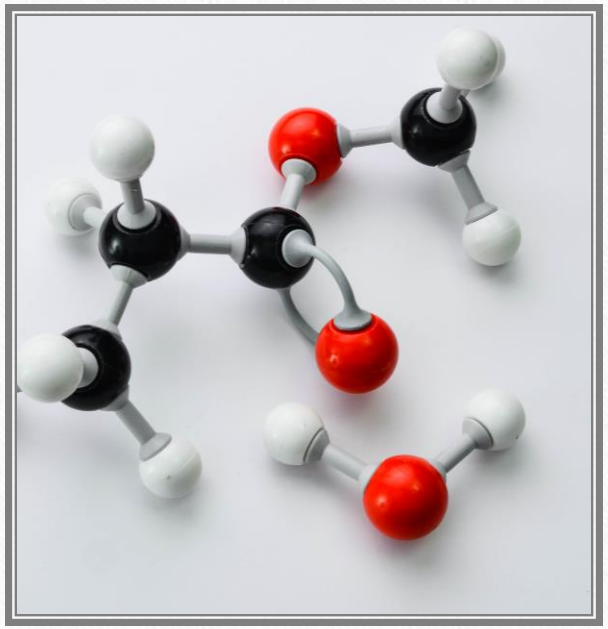
Lab: Solubility Lab

Equipment: Beakers, water, salt, Sodium Nitrate, sugar, Vegetable Oil, Egg yolk,

Design: Beakers are going to be filled with water. Students are going to be adding different substances to the beaker filled with water and note whether they are soluble (dissolve) or non-soluble (doesn't dissolve). The substances selected are cheap and easily attainable for a teacher. Salt, Sodium nitrate are ionic compounds which should dissolve in water. While Vegetable oil and egg yolk are molecular compounds which shouldn't dissolve in water. Students will note observations and note down why these compounds either dissolve or do not dissolve and provide a hypothesis as to why. Sugar is also added to demonstrate that some molecular compounds do dissolve. The students will provide a hypothesis as to why sugar is able to dissolve while vegetable oil and egg yolk are unable to.

Unit 3: Organic Chemistry (33%)

- The study of the structure, properties, composition, reactions and preparation of carbon-containing compounds
- Learn how to classify and name different organic compounds using IUPAC formatting
- Students should have about 40% of their time in hands-on, minds-on exploration



Specific Curriculum Outcomes

- Subtopic 1: So Many Compounds (1 hour)
  - explain the large number and diversity of organic compounds with reference to the unique nature of the carbon atom (319-4)
- Subtopic 2: Influences of Organic Compounds on Society (1 hour)
  - explain how synthesizing organic molecules revolutionized thinking in the scientific community (115-3)
  - explain how organic chemistry has evolved as new evidence has come to light (115-6)
  - identify various constraints that result in trade-offs during the development and improvement of technologies (114-4)
  - provide organic chemistry examples of how science and technology are an integral part of their lives and their community (117-5)
  - analyze natural and technological systems to interpret and explain the influence of organic compounds on society (116-7)
- Subtopic 3: Classifying Organic Compounds (6 hours)
  - classify various organic compounds by determining to which families they belong, based on their names or structures (319-7)

Specific Curriculum Outcomes

- Subtopic 4: Naming and Writing Organic Compounds (6 hours)
  - write the formula and provide the IUPAC name for a variety of organic compounds (319-5)
- Subtopic 5: Applications of Organic Chemistry (3 hours)
  - identify limitations of the IUPAC classification system and identify alternative ways of classifying to accommodate anomalies (214-2)
  - distinguish between scientific questions and technological problems (115-1)
  - select and use apparatus and material safely (213-8)
  - provide a statement that describes the relationship between bonding and organic chemistry investigated in light of the link between data and the conclusion (214-11)
  - evaluate the design of a technology and the way it functions, on the basis of a variety of criteria that they have identified themselves (118-4)
  - identify and apply criteria, including the presence of bias, for evaluating evidence and sources of information on an organic topic (214-9)

Specific Curriculum Outcomes

- Subtopic 6: Isomers in Organic Chemistry (2 hours)
  - define isomers and illustrate the structural formulas for a variety of organic isomers (319-6)
- Subtopic 7: Writing and Balancing Chemical Equations (3 hours)
  - write and balance chemical equations to predict the reactions of selected organic compounds (319-8)
- Subtopic 8: Polymerization (1 hour)
  - define problems to facilitate investigation of polymers (212-2)
  - design an experiment identifying and controlling major variables (212-3)
  - describe processes of polymerization and identify some important natural and synthetic polymers (319-9)

Specific Curriculum Outcomes

- Subtopic 9: Risks and Benefits of Organic Compounds: STSE Perspectives (2 hours)
  - communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others (215-1)
  - describe and evaluate the design of technological solutions and the way they function using scientific principles (116-6)
  - analyze from a variety of perspectives the risks and benefits to society and the environment of applying organic chemistry knowledge or introducing a particular technology (118-2)
  - develop, present, and defend a position or course of action on organic chemistry based on findings (215-5)
  - select, integrate, and synthesize information from multiple sources including various print and electronic sources, and make inferences on this information (213-7, 215-3)
  - debate the merits of funding specific scientific or technological endeavours and not others (117-4)

Connections to the Real World – Lab/Tech Ideas

Objective: Be able to identify and construct the multiple types of organic characteristics in organic chemistry (Alkane, Alkene, Alkyne, Alcohol, etc.) Create visual comprehension in organic structures, can be introduced in Unit 2 to further enhance learning of structures of compounds.

Lab: Model Kit Building

Equipment: Chemistry Model Building from Amazon (In reference). Can also be done online such as https://molview.org/

Design: Provide a worksheet that has multiple types of Organic Molecules. Students are to attempt to construct these molecules using the selected form of model building. Additional questions can be built into the work sheet to improve student comprehension of the IUPAC classification system or even creating and balancing of equations. Can also provide the description of a structure and have the students attempt to build it and then solve the name of the molecule created.

Safety Considerations

- Lab waiver signed on the first day of the course, WHMIS Completed
- Lab PPE: safety googles, lab coats, protective gloves, closed-toed shoes, hair tied back, no contact lenses & no skin exposed
- First aid kit
- Safety showers
- Eye wash station
- Fire extinguishers
- Fire blanket
- Chemical fume hood
- Allergies
- Proper Equipment

Teacher Resources

https://curriculum.novascotia.ca/sites/default/files/documents/curriculum-files/chemistry%2011-12%20Guide%20(2009).pdf

Chem 11 GCOs and SCOs

- https://www.creativebookpublishing.ca/books/Nelson-Chemistry-11.pdf

Course textbook: Nelson Chemistry 11 by Frank Jenkins, Hans Van Kessel, and Davi. Published in 2001.

- https://drive.google.com/file/d/1Sk4q7-djS0JV_znE10gkXyGR-MNbxJg_/view

Science Safety Guidelines for the Classroom

- https://curriculum.novascotia.ca/sites/default/files/documents/resource-files/Acceptable%20Chemicals%20(2024).pdf

Acceptable chemicals for lab use, help design labs

https://curriculum.novascotia.ca/sites/default/files/documents/resource-files/Micro%20Burner%20Safety%20Guidelines%20UPDATE%202024_EN.pdf

Burner safety within the classroom

https://curriculum.novascotia.ca/sites/default/files/documents/resource-files/Chemistry_Data_Booklet%20%28RevNov2014%29.pdf

Data Booklet for students in Chemistry 11

Student Resources

https://www.youtube.com/
Youtube is a helpful student resources, recommended channels: Mr. McClure, The Organic Chemistry Tutor, Professor Dave Explains

https://www.khanacademy.org/science/chemistry
Select unit information, can be accessed from home

https://www.acs.org/education/resources.html
American Chemical Society, allows access to more resources from home

AI
AI can help enrich student learning, can use ChatGPT, NinjaTech AI, Google Gemini, etc.

References

- https://www.worksheetsplanet.com/what-is-stoichiometry/
- https://curriculum.novascotia.ca/sites/default/files/documents/curriculum-files/chemistry%2011-12%20Guide%20(2009).pdf
- Organic Chemistry. https://www.acs.org/careers/chemical-sciences/areas/organic-chemistry.html
- Encyclopædia Britannica, inc. (2025, August 26). *Molecule*. Encyclopædia Britannica. https://www.britannica.com/science/molecule