College Chemistry Canada
La Chimie Collégiale au Canada

Newsletter

VOLUME 47, ISSUE 1 SEPTEMBER, 2024

In This Issue:

MESSAGE FROM THE PRESIDENT

Dear C3 Members,

Welcome back to school! I wish you all an academic year of keen learners and easy marking.

This year will be my last as C3 President as we have cajoled Mary Sheppard from St. Mary's University, NS to take on the role as incoming president. I look forward to working with her as she transitions into the president position.

The 2024 C3 conference was held at Trent University, in Peterborough, and spectacularily organized by Shannon Accettone. If you were able to attend, thank you, as we celebrated the 50th in person conference. Shannon scheduled many engaging activities to mark this amazing milestone for C3. As always, it is a pleasure to connect with each of the attendees. I had many opportunities to learn and celebrate.

We also launched the new C3 webpage. If you haven't had a chance to check it out, I encourage you to so. Laura and Mel did an excellent job of updating the page and contents.

We have confirmed that the 2025 (May 23 – 25) conference will be held at Simon Fraser University, BC and will be organized by John Canal. Thanks so much for stepping up John!

At the AGM we voted in several new executive and board members. Please see below.

C3 EXECUTIVE

President	Paula Rooksby	NAIT, AB
Incoming President	Mary Sheppard	St. Mary's University, NS
Past-President	Jimmy Lowe	BCIT, BC
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Quebec	Yan Brouillette	Dawson College, QC
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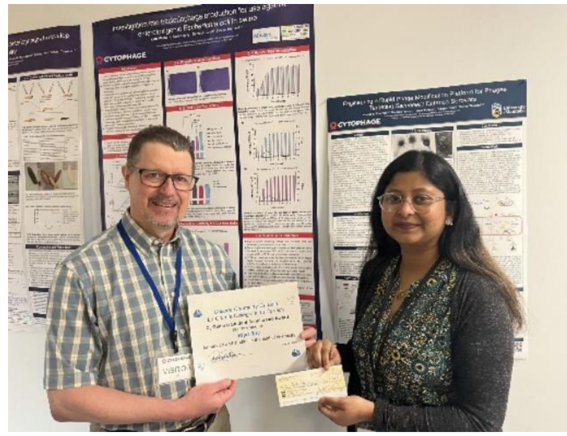
Prairies	Lawton Shaw	Athabasca University, AB
BC/Yukon	Jennifer Wolf	BCIT, BC

Finally, thank you members for your continued participation and enthusiasm in our professional community!

Here's to another great year!

Paula Rooksby
C3 President

College Chemistry Canada General Student Awards – 2024



Riya Roy

University of Lethbridge, Lethbridge, AB

Riya is a top-notch TA with a great work ethic. She taught Chemistry 1000 (General Chemistry I) labs for most of her TA duties and as the Chemistry 1000 lab coordinator I was her direct supervisor for those duties. She did an absolutely fantastic job teaching her lab sections and had no trouble with the general chemistry material in each experiment. She always came well-prepared and was always in lab several minutes early to be available for last-minute questions from students and to make sure everything was set up for any demonstrations she was planning to do in her pre-lab talk. She made sure to clarify any questions she had about the lab with me well before she was to teach it to her students. After the Fall 2023 semester ended Riya had to move to the University of Manitoba because her research supervisor moved there. She was still considered a U of L graduate student so she was looking for a TAship with us that she could do remotely, since she couldn't be on campus to teach labs in person. When she told me this, and knowing how diligent she is, I jumped at the chance to suggest to the person who assigns the TAships for our department that Riya be assigned to me as a marker for my CHEM 2740 (Physical Chemistry I) lab. She did a great job marking the reports I assigned to her. All in all, I have greatly enjoyed having Riya be a TA for me. – *Wayne Lippa, University of Lethbridge*

Sam Holleman

Northern Alberta Institute of Technology, Edmonton, AB

Sam Holleman is a 2024 NAIT Chemical Technology Graduate. I would like to nominate him because of his love of Chemistry and his academic journey that has taken him to this moment.

It was only in his last year of high school when he learned Chemistry and he really enjoyed it. Then he decided to pursue the love further by applying to the Chemical Technology program at NAIT. During his two years at NAIT, he has shown his exceptional dedication and aptitude to his studies. He always embraced all challenges with enthusiasm and a smile. His instructors and peers were always impressed with his abilities in lab and theory. Some of his milestones are documented in the #naitchemtech Instagram page (https://www.instagram.com/naitchemtech/) where he is a part of many videos and pictures; as he was the winner of the Phys Chem R squared challenge in 2023.

Now that he has graduated, he is taking the next step in his academic journey by applying to a BSC in Chemistry at the University of Alberta. We wish him nothing but the best for this future endeavors. – *Melanie Kaban, NAIT*

COLLEGE CHEMISTRY CANADA HOST INSTITUTION STUDENT AWARD – 2024

Jack Lahey

Trent University, Peterborough, ON

Jack is a chemistry student at Trent University entering third year in the 2024-2025 academic year. This summer, he worked on a research project involving the environmental impacts of end-of life electronics. Jack enjoys being able to share his interest in chemistry with others, such as via Trent's enrichment courses and hosting STEM programs at his hometown library last summer. Outside of classes, Jack has been involved in the chemistry department as the treasurer for the Chemistry Undergraduate Society and as a volunteer at the 51st Southern Ontario Undergraduate Student Chemistry Conference (SOUSCC), held at Trent University in March 2023. Jack is interested in pursuing a career in analytical or medicinal chemistry.

Submitted Articles

Fundamental Skills Development in the Chemistry Laboratory – Preliminary Student Perceptions of Analytical Chemistry Skills Mastery

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Shannon Accettone (shannonaccettone@trentu.ca) Trent University, Peterborough, ON

Mastery-based grading is alternative grading approach that allows students to retake examinations or redo assignments as often as they like to attempt to improve their grades. This occurs ideally until students have "mastered" the material (Armacost & Pet-Armacost, 2003). Unlike traditional grading, which assesses students based on their understanding of material at a single point in time, mastery grading focuses on rewarding ongoing learning and improvement in content knowledge with a growth-mindset (Harsy & Hoofnagle, 2020). Traditional grading does not account for progressive learning after the initial assessment, while mastery learning motivates students to continuously improve and deepen their understanding of the material. Given the importance of grades as a motivator, previous studies suggested that grades can be used more to increase learning across multiple disciplines (Lin et al., 2003; Pongračić et al., 2022).

The iterative learning process of mastery-based learning is particularly well-suited for implementation in an analytical chemistry course due to its focus on the development and refinement of practical laboratory skills (pipetting, burettes and titrations, solution preparation, weight-by-difference mass measurements, and quantitative transfer) and other analytical techniques. This approach could not only lead to improved accuracy grades in the laboratory but also provide students with transferrable skills that may be used in further chemistry courses at Trent. Additionally, it would enhance the skill and laboratory literacy valued by future employers in chemical sciences (Hamilton et al., 2024). In a lecture context, the students can apply the content they learn to different scenarios, demonstrating their understanding rather than simply regurgitating information.

Mastery-based grading was applied to summative exams and laboratory assessments in an introductory analytical chemistry course at Trent University (Peterborough, ON). The midterms and exam in this course were heavily applications based, so having a full understanding of the material was paramount to students' success in the course. With this in mind, emphasis was placed on mastery of the content by allowing students to attempt to increase their grades on each subsequent exam by being tested on the previously learned content in conjunction with being tested on recently learned material (similar to a cumulative test). The incentive of a chance to improve their grade in turn was an opportunity for students to re-learn content they may have previously missed. This same concept was applied to the laboratory content where students were allowed to resubmit accuracy values or demonstrate their practical laboratory skills assessments an unlimited number of times throughout the semester.

Content analysis on open responses to the survey question, "What do you believe is the most important thing CHEM 2400H (Introduction to Analytical Chemistry) has taught you this semester?" revealed that laboratory aptitude comprised of over 50% of the open responses, of which 80% of those were directly in context of honing lab skills. This highlights the importance that students place on learning practical laboratory skills within the analytical chemistry laboratory. Students liked that they were able to see the "progression of their skills development" throughout the semester through the iterative learning process with immediate feedback. Students also found that they "grew more confident in their abilities with practice as labs progressed." The competency that students felt they gained through the repetition of the skills allowed them to then focus on obtaining more accurate and precise data to "achieve the best results possible for success". Overall, preliminary results suggest that students perceive that there was a benefit to implementing mastery grading on their overall learning experiences in analytical chemistry. Student feedback will help to refine the future iterations of the course to achieve a goal of enriching the overall student learning experiences in chemistry courses. A more detailed analysis of students' perceptions of mastery-based grading is still to come.

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Green Chemistry Efforts at the University of Toronto

Andrew (Andy) Dicks (andrew.dicks@utoronto.ca) University of Toronto, Toronto, ON

This contribution summarizes a poster and talk I presented at Trent University during the 50th College Chemistry Canada Conference. We have been teaching concepts of green chemistry and sustainability in our department for two decades, and a major driver for curricular change was signing on to the Beyond Benign Green Chemistry Commitment (GCC) in 2016. In doing so we became the first international school to sign the GCC, which is a voluntary initiative set up to assist in the preparation of chemists whose skills are aligned with the needs of the planet and its inhabitants in the 21st century. This move provided great impetus for us to infuse more green principles into components of our undergraduate program separate from organic chemistry (most notably into first-year general chemistry and second-year inorganic courses, as well as introducing toxicology concepts into an upper-level environmental chemistry course), by adopting more of a systems-thinking approach to education. As of writing, 14 Canadian institutions have signed the GCC (Figure 1), ranging from a Quebec CEGEP to colleges and universities across the country. It is highly recommended that you investigate the GCC as a means to embed green chemistry education into your undergraduate offerings!

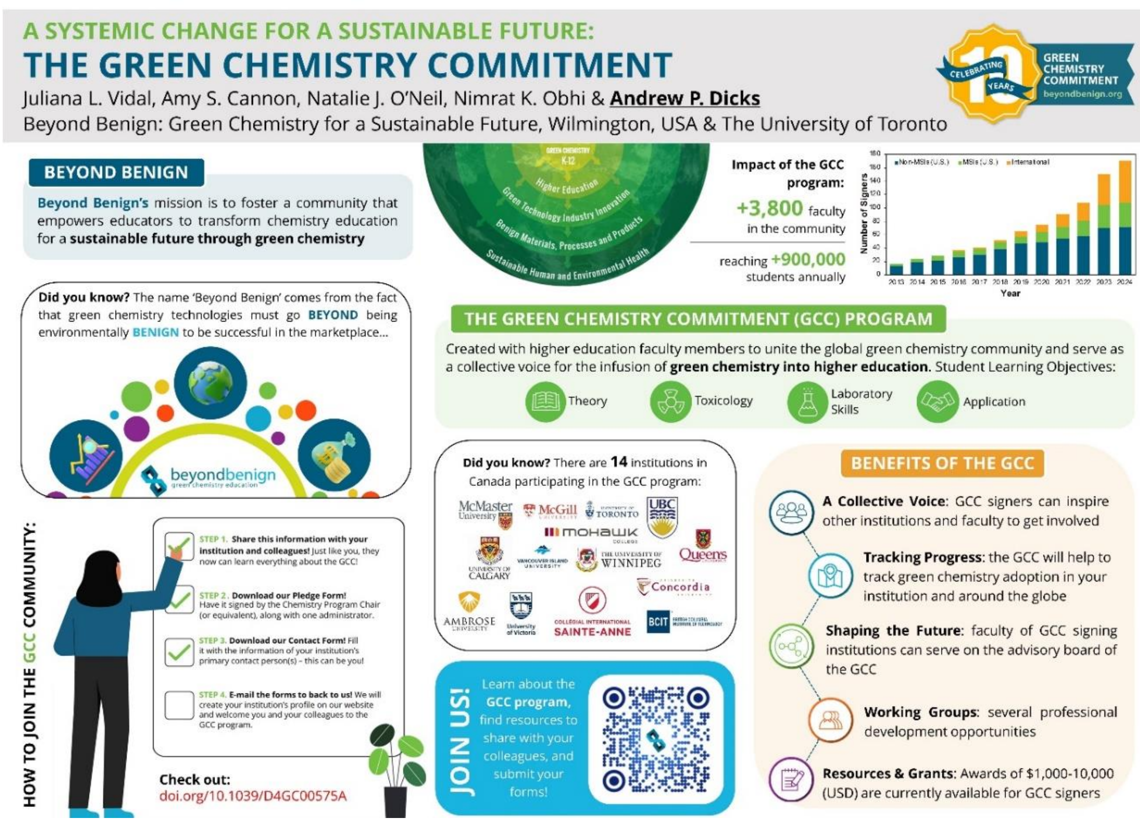

Figure 1: The Green Chemistry Commitment.

We departmentally mount 10 undergraduate programs for students interested in studying chemistry in different areas and to varying extents: six Specialists, two Majors and two Minors (www.chemistry.utoronto.ca/programs-studies/overview). In 2021, a Focus in Green Chemistry designation was developed to recognize students who combine undergraduate courses that cover principles of toxicology, reaction metrics, safer chemicals/solvents, pollution prevention/recycling, catalysis, and energy efficiency. This Focus appears on the academic transcript of any student graduating from a Specialist program (Biological Chemistry, Chemical Physics, Chemistry, Material Science, Pharmaceutical Chemistry, and Synthetic & Catalytic Chemistry) or a Major program (Chemistry and Environmental Chemistry). This is a concrete notation for potential employers that a student has learned the fundamentals of green chemistry in the context of different courses (www.chemistry.utoronto.ca/undergraduate/current-students/undergraduate-courses, Figure 2). There are currently over 55 students enrolled in the Focus in Green Chemistry.

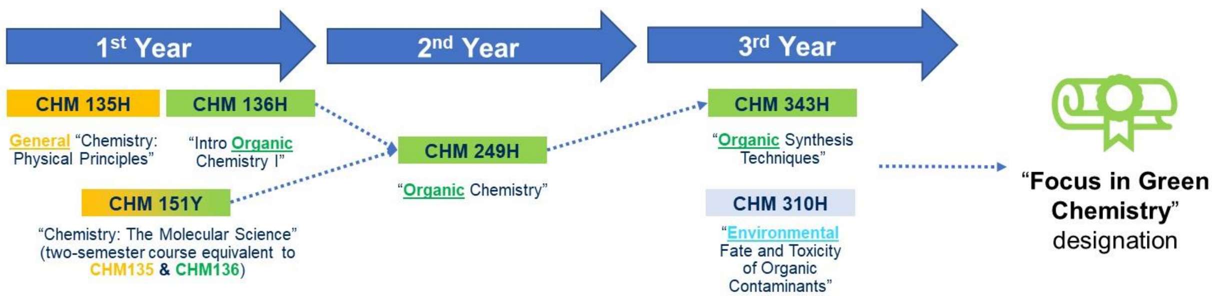

Figure 2: Focus in Green Chemistry Pathway at the University of Toronto.

Many thanks to my colleagues (most notably Barb Morra, John De Backere, Kylie Luska and Hui Peng) for their contributions made towards my talk. Please do reach out to me (andrew.dicks@utoronto.ca) to learn more about our green chemistry journey!

Sample References

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"How Do You Do, Fellow Kids?" – A Guide for the Appropriate Use of Gen Z Slang for Teaching in a Chemistry Context

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Immediacy is a communications concept that relates verbal and non-verbal communication attributes that increase the feeling of closeness between communicators[1]. In a systematic review by Liu[2]**,** teacher immediacy is associated with positive student motivation and higher student achievement. The use of positive slang, meaning slang words that are perceived as positive by students, such as "cool" and "awesome", is associated with a positive classroom climate, which can improve student motivation and learning[3]. The use of humor has also been correlated to high instructor immediacy in the classroom[4]. Subject-matter related humor and self-disparaging humor were identified by post-secondary students as the most appropriate form of humor used in the classroom[5].

Slang is the informal, mainly verbal, language used by a particular group of people. It is important to note that slang terms adopted by the dominant or mainstream culture are often appropriated from minorities such as the African American and the lesbian, gay, bisexual, and transgender (LGBT) communities via social media; appropriation should be done with acknowledgement, awareness, and respect for the origins of the terms[6]. Urban Dictionary, a crowd-sourced online lexicon has been used by linguists as a repository for information and definitions of slang words[7,8]. Due to the crowd-sourced nature and inconsistent levels of content moderation, caution should be used when using Urban Dictionary as a source for linguistic studies and suggest that Wiktionary may be a more reliable source due to the content moderation[9].

Chemistry educators have suggested the use of humour[10], memes[11], movie scenes[12], and comics[13] to engage students in the classroom. I have used Urban Dictionary, Wikipedia, and Wiktionary as sources of definitions of common Generation Z slang and have given examples of conventional or traditional usage of some slang terms in the chemistry context, as well as how the slang usage of the term could be applied to the chemistry classroom (Table 1). These examples are intended to add humour and increase immediacy in the classroom environment. For example, when assessing a student's experimental yield, the educator could correctly employ the usage of the slang term "fire" by saying "these results are what kids today would call fire." The usage of the slang could be seen as humorous by students, which would increase the educator's immediacy in the classroom.

Conclusions

Chemistry educators can use the information presented in Table 1 to become acquainted with common slang words and use them in the chemistry classroom to increase their immediacy with their students.

Table 1: Gen Z Slang terms, their definitions, and examples of incorrect and correct usage of these terms in the chemistry context

Slang term	Crowd-sourced definition	Conventional chemistry use(s)	Correct slang use(s)
basic	Used to denote those who prefer mainstream products, trends and music[14].	"A solution with a pH greater than 7 is **basic.**" "The nitrogen of aniline is weakly **basic**."	**"**Bohr's model of the atom is pretty **basic**. The quantum mechanical is more refined."
drip	Style, swagger, fashionable and/or expensive clothing[15]	"Add one more **drip** of titrant from your burette, you are close to the endpoint." "Your ice bath is **drip**py."	"I see you have your safety glasses, lab coat, long pants, and closed toed shoes. Nice **drip**." "The proper **drip** for this experiment is a face shield and chemical resistant gloves."
fire	Something that is amazing[16]	**"**If you put sodium metal in water it will make a **fire**."	"Boyle's Law was a **fire** discovery because it led to the scientific revolution."
fr	A shortened form of "for real." [14] Used to express agreement or as disbelief when expressed as a question[17].	"Element number 87 is **Fr**."	**"**If you get concentrated acid on your skin, it will burn you **fr**."
it's giving	Describe the attitude or connotation of something or someone[14]	"**It's giving** electrons and becoming a cation." "**It's giving** protons to the base in this reaction."	When describing a synthetic pharmaceutical analogue of a nucleotide: "**It's giving** cytidine."
lit	Colloquially: "Enlightened", "Hot", "Fire." The new hotness; something remarkable, interesting, fun or amusing. Generally positive[14]	In the context of instrumental analysis: **"**The gas pressure on the AA should be ~15 psi when the flame is **lit**."	In the context of collision theory: **"**When the molecules have enough kinetic energy to surpass the activation energy require for the reaction, things get pretty **lit**."
mid	Labelling something as average or poor quality[18]	"This IR spectrum is **mid**-IR."	"A 40% yield in for this reaction is **mid**."
NPC	Someone who cannot think for themselves and/or has no or little control over their own life[14]	"4-Nitrophenyl carbonochloridate (abbreviated **NPC**) forms cream crystals with an acrid odor."	"Despite the lack of credit for her work, Rosalind Franklin wasn't an **NPC."**
no cap	Cap is another word for lie. Saying "no cap" means that you aren't lying, or if you say someone is "capping," then you are saying they are lying[14]	"The second letter in an element symbol has **no cap**." "Be careful, your volumetric flask has **no cap**."	When discussing redox potentials: "Fluorine is a stronger oxidizer than chlorine, **no cap**."
periodt	Used to add emphasis to a subject; placed end of a sentence as with a period. Similar to the British term "full stop"[14]	"Use the **periodt**ic table to predict what the ionization state of the element will be."	In the context of choosing a wavelength for spectroscopic analysis: **"**403 nm is the optimal wavelength for this analysis **periodt**."
ratio	When a reply, particularly on Twitter or TikTik has better reception and more likes than the original post being replied to[14]	"The mole **ratio** of conjugate base to acid can be put into the Henderson-Hasselbalch equation."	"The paper was retracted because numerous studies found no evidence for the claims. The paper got **ratio'**d"

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Chemical Safety Training in Academia and Schools: It's Not Only WHMIS

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No matter at which level we teach and what our specific duties are, we need relevant chemical safety trainings, particularly laboratory safety trainings. The latter shall naturally begin with WHMIS training. Then, within our programs, we need to pass on this knowledge to our students and make sure they master it before they perform laboratory tasks.

Providing chemical safety trainings to students can be challenging; some questions need to be asked and answered: How can we adapt our trainings to our course and program contents, and to our specific duties (as lab coordinators, for example)? What needs to be covered and how deep do we need to go? There is more than one chemical safety systems officially in use in Canada and our students will likely be exposed to all of them during their career. What would be a good basic knowledge of these systems? This article aims at providing highlights of the main chemical safety systems in use in our country in the hope that this will help answer the above questions.

The four important Canadian chemical safety systems are:

1. The **Workplace Hazardous Materials Information System (WHMIS)**, version 2015 (to protect workers),
2. The **Transportation of Dangerous Goods Regulations (TDGR)** (to protect the environment and the public),
3. The **Consumer Chemicals and Containers Regulations (CCCR)** (to protect consumers), and
4. The **Pest Control Products Regulations (PCPR)** (to protect general public).

Besides, and although it is not a Canadian system, we will also briefly describe the Standard Code 704 of the U.S.A. **National Fire Protection Association (NFPA 704)** because it is still often noticed in Canada on chemical containers, packaging, door signs, etc.

Health Canada department coordinates the applications of WHMIS, CCCR and PCPR across the country (although WHMIS is also overseen by provincial and territorial workplace health and safety organisations). On their side, TDGR are applied under the authority of **Transport Canada** department.

1. Workplace Hazardous Materials Information System (WHMIS)

The first version of WHMIS was introduced in 1988. Later on, an international system was developed through the United Nation: the **Globally Harmonized System (GHS) of Classification and Labelling of Chemicals**. Certain elements of the GHS were integrated in a new version of WHMIS in 2015 (the **WHMIS 2015**). These elements are:

a) **Hazard classification** (20 classes of physical hazards; 12 classes of health hazards)
b) **Cautionary labelling of containers** (involving 8 GHS pictograms plus WHMIS 1988 "Biohazardous Infectious Materials" pictogram)
c) The provision of **safety data sheets, SDS** (16 sections), and
d) **Worker education programs**

Figure 1 shows the type of hazards in GHS/WHMIS 2015, WHMIS 1988 and CLP* pictograms (*CLP = **C**lassification, **L**abelling, **P**ackaging of European Union). Note that the "HEALTH (Environmental)" pictogram is **NOT** actually part of WHMIS 2015.

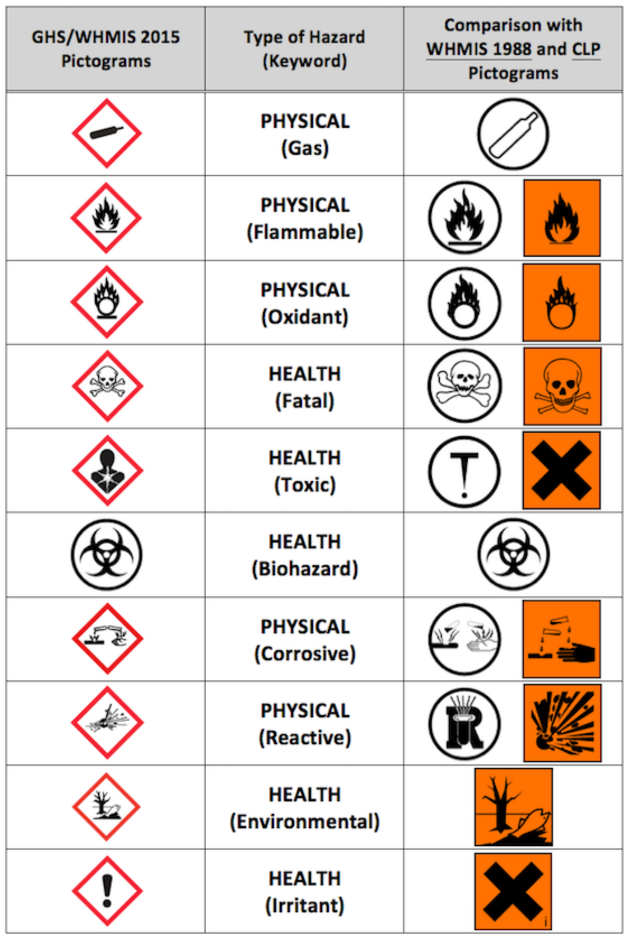


Figure 1: Comparison of pictograms and types of hazards

If your chemical inventory contains bottles or jars showing any of the pictograms appearing in the third column of this table, **it does not comply** with WHMIS 2015 and this may lead to warnings or penalties if found during inspections.

Nowadays, WHMIS 2015 training is well integrated in chemistry laboratory programs in Canada and we can expect students to have a good knowledge of it. Moreover, if WHMIS training is taught at pre-university levels, it can also be used as a tool to consolidate basic chemical knowledge like "properties of matter" found in Safety Data Sheets (SDS); for example, flash point, autoignition temperature, flammability limits, vapour pressure, specific gravity, toxicology, and many more.

2. Transportation of Dangerous Goods Regulations (TDGR)

After a major railway accident that happened on November 10th 1979 in Ontario (the so-called "Mississauga Miracle"), Canada government established its first Transportation of Dangerous Goods Act (TDGA) in 1980. From this Act, the first TDGR were developed between 1980 and 1985. TDGA was revisited in 1992 and, after several reviews, it led to the current TDGR version which most recent amendment was made on October 25th 2023. All in all, it has not been so long ago that transportation of dangerous goods was regulated (only since about 40 years!).

Dangerous goods are defined as "*products, substances or organisms included by their nature or by the TDGR in any of the 9 classes listed in **Table 1** below*". This table is also showing the typical pictograms associated with each class. These pictograms have to be properly displayed on packaging, trucks, and railway cars transporting dangerous goods. If the nature of substances needs to be specified on packaging, trucks and railway cars, explicit substance numbers (the substance "UN numbers") may be added to displayed pictograms. All of this is done in accordance with very precise guidelines.

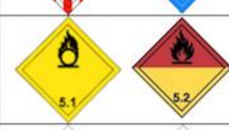
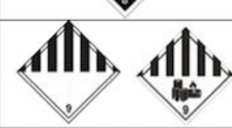
1. Explosives, including explosives within the meaning of the Canadian *Explosive Act*	
2. Gases: compressed, deeply refrigerated, liquefied or dissolved under pressure	
3. Flammable and combustible liquids	
4. Flammable solids; substances liable to spontaneous combustion; substances that on contact with water emit flammable gas	
5. Oxidizing substances; organic peroxides	
6. Poisonous (toxic) and infectious substances	
7. Nuclear substances, within the meaning of the Canadian *Nuclear Safety and Control Act*, that are radioactive	
8. Corrosives	
9. Miscellaneous products, substances or organisms, and Lithium Batteries	

Table 1: Classes of Dangerous Goods in the TDGR

From Table 1, we can see that TDGR are based on very concrete chemical properties of matter. Moreover, signs of TDGR can often be seen in day-to-day life; as placards on packaging, trucks, and railway cars, for example. For this reason, it is probably justified to include basic information about TDGR in chemistry courses and laboratory programs as necessary knowledge.

Also, TDGR are the fundamental bases of the **National Fire Code of Canada (NFCC)** and the Transport Canada **Emergency Response Assistance Plan (ERAP)** through the North American **Emergency Response Guidebook (ERG)** (for your information, the respective covers of these two resources are shown in Figure 2 below). The latter (especially the ERG) contain lots of information that can selectively be integrated in chemistry courses and laboratory programs as relevant knowledge.

Figure 2: Cover pages of the 2020 National Fire Code of Canada (NFCC) and of the 2024 Transport Canada Emergency Response Guidebook (ERG)

3. Consumer Chemicals and Containers Regulations (CCCR) and Pest Control Products Regulations (PCPR)

In many ways, **CCCR** and **PCPR** have a number of common features (for example, they share similar pictograms that are different from the ones used in WHMIS 2015 and TDGR); hence the treatment of these two regulations in a single section of this article.

According to the **Canada Consumer Product Safety Act (CCPSA)**, a Consumer Product is "*a product, including its components, parts or accessories, that may reasonably be expected to be obtained by an individual to be used for non-commercial purposes, including for domestic, recreational and sports purposes, and includes its packaging.*" This is quite a wide definition; but let's put the focus on the fact that the products involved in this Act can also be of concern to the general public.

Table 2 below lists the 5 CCCR hazards categories. There are sub-categories for each of the first three categories, depending on their hazard degree. For example, "TOXIC" includes "Very Toxic", "Toxic", and "Harmful" sub-categories depending on toxicological properties of the substance.

1. **TOXIC** products	
2. **CORROSIVE** products	
3. **FLAMMABLE** products	
4. **Quick skin-bonding adhesives**	No pictogram
5. Pressurized containers (**EXPLOSIVE**)	

Table 2: The 5 CCCR hazards categories

In the CCCR context, an octagonal pictogram refers to properties of the substance (toxic, corrosive or flammable) while an inverted triangle indicates a hazard due to the container. For example, the "EXPLOSIVE" pictogram indicates risks of injuries due to particles of the containers that may be projected.

A similar approach applies for PCPR since, according to the **Pest Control Products Act (PCPA)**, Pest Control Product "*means*

a) a product, an organism or a substance, including a product, an organism or a substance derived through biotechnology, that consists of its active ingredient, formulants and contaminants, and that is manufactured, represented, distributed or used as a means for directly or indirectly controlling, destroying, attracting or repelling a pest or for mitigating or preventing its injurious, noxious or troublesome effects;
b) an active ingredient that is used to manufacture anything described in paragraph (a); or
c) *any other thing that is prescribed to be a pest control product.* "

PCPR uses pictograms that are very similar to the ones involved in CCCR. They refer to the same hazards: **TOXIC (or POISON)**, **CORROSIVE**, **FLAMMABLE**, and **EXPLOSIVE** ("Quick skin-bonding adhesives" are not involved in PCPR); sub-categories also exist.

But in PCPR, and depending on the intensity of the risks, hazard symbols may be surrounded by three possible polygons: **diamond-shaped** (for "**Warning**"), **inverted triangle** (for "**Caution**"), or **octagon** (for "**Danger**"). These shapes and symbols are shown in **Figure 3**.

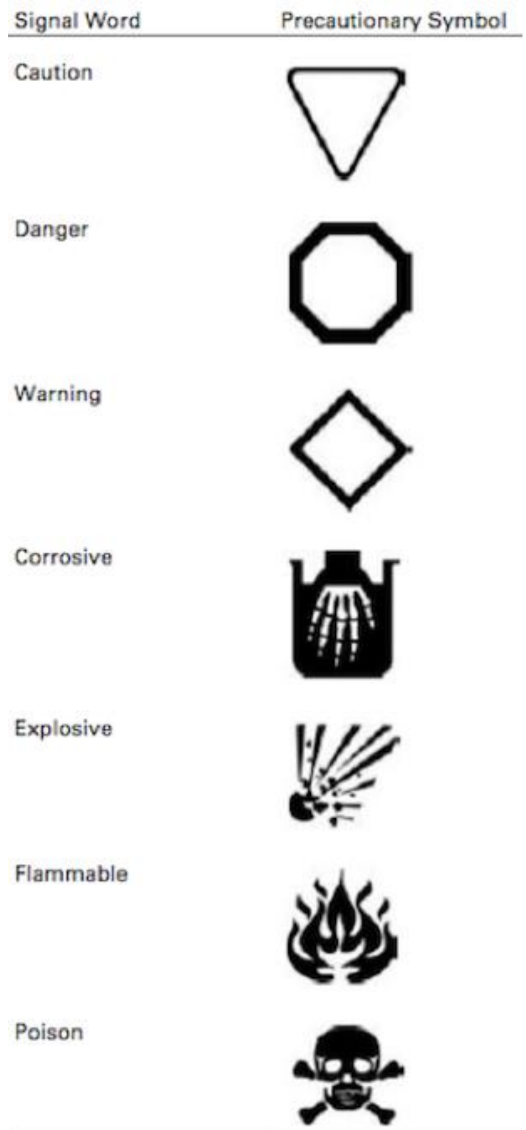


Figure 3: Shapes and symbols applied in PCPR pictograms (Source: Schedule 3 of the PCPR)

For all these systems (WHMIS, TDGR, CCCR, and PCPR), "the devil is in the details" of these regulations. Legal guides and texts will specify many aspects of them. For example, all classes, categories, and sub-categories are defined from International, Canadian or American standards that are determined scientifically. This is why it is important to be trained by people with strong scientific background, ideally by chemistry professionals.

4. The U.S. National Fire Protection Association Standard Code 704 (NFPA 704)

At this stage of the present article, it is worth to mention the U.S. NFPA 704 standard code. Although the latter is an American system, it is often seen on bottles and jars of chemicals, and on many packaging. This system, often referred to as the "**NFPA fire diamond**", describes the various hazards that can be attributed to substances.

Figure 4 describes the many features of NFPA 704 Fire Diamond. Through a number between 4 and 0, **Fire hazards** (in red) are considered at the top of the diamond, **Health hazards** are indicated in blue on the left, **Reactivity hazards** appear in yellow on the right, and **any other specific hazards** are given in the white diamond at the bottom. **It is very important to notice that, contrary to the GHS/WHMIS and TDGR systems, the highest number represent the most important risk in NFPA 704.** This is something very relevant to know as it may cause confusion and this is probably why this system is not officially adopted in Canada.

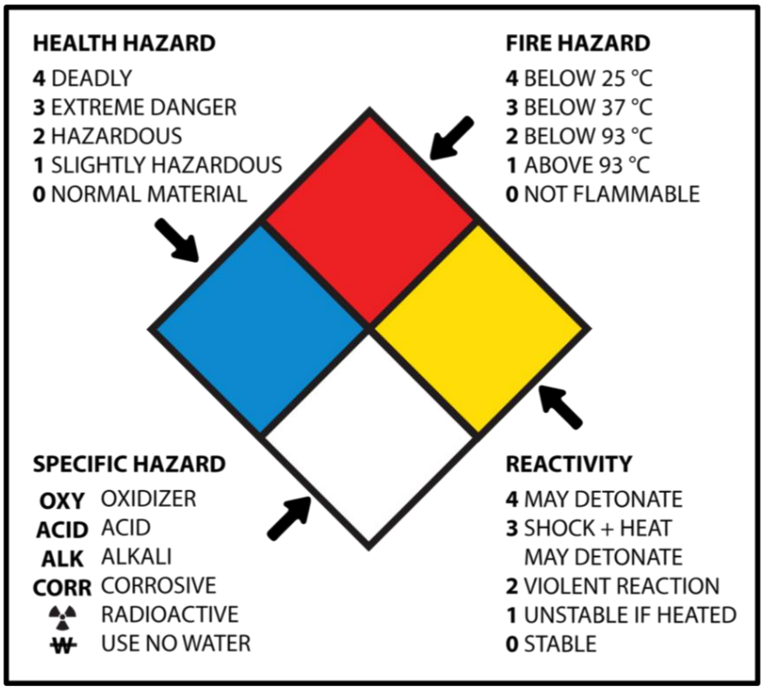


Figure 4: NFPR 704 Fire Diamond (Source: commons.wikimedia.org/wiki/File:NFPA-704-diamond-standard.svg)

Conclusion

In this article, we have described the four official chemical safety systems in use in Canada (WHMIS 2015, TDGR, CCCR and PCPR) and we have briefly introduced the U.S. NFPA 704 code as complementary information. Among these systems, the TDGR are probably the most important ones since NFCC and ERAP/ERG are directly related to them.

Such systems should be introduced to students (and staff) within laboratory programs and courses. Professors or instructors may decide how deep to go with this material. Students involved in scientific programs (especially in chemistry) should be introduced to these systems, as they will certainly be exposed directly or indirectly to them during their career.

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- **Consumer Chemicals and Containers Regulations (CCCR)**; (accessed April 2024) laws-lois.justice.gc.ca/eng/regulations/sor-2001-269/index.html.
- **Pest Control Products Regulations (PCPR)**; (accessed April 2024) laws-lois.justice.gc.ca/eng/regulations/sor-2006-124/index.html.
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- **National Fire Code of Canada 2020 (NFCC)**; (accessed April 2024) nrc.canada.ca/en/certifications-evaluations-standards/codes-canada/codes-canada-publications/national-fire-code-canada-2020.
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Academic Support for Incoming First-Year Students

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One challenge in teaching large introductory courses is the enormous diversity of student backgrounds in prior knowledge, skill sets, and study skills. The Faculty of Arts & Science at University of Toronto initiated the Arrive Ready program in the summer of 2020 after high school education was impacted by the pandemic to provide incoming students with free academic support to ensure a solid foundation and increase student confidence before starting university. Along with Paniz Pahlavanlu, a graduate student working under my supervision, I developed an online course for Arrive Ready Chemistry featuring math and chemistry modules that cover foundational review topics for incoming life science students. The topics included are shown in the table below:

Math Topics		**Chemistry Topics**	
1	Scientific Notation	1	Units
2	Fractions	2	Density
3	Order of Operations	3	Elements, Atoms, Moles, Molar Mass
4	Exponents and Logarithms	4	Formulas
5	Quadratic Equations	5	Chemical Equations
6	Rearranging Equations	6	Limiting Reactants
7	Graphing	7	Percent Yield
		8	Molarity and Solution Stoichiometry
		9	Sequences of Reactions
		10	Bonding and Electronegativity
		11	Drawing Lewis Structures
		12	Shapes of Molecules

In Summer 2020, this asynchronous course operated in a stand-alone fashion, while in subsequent summers (2021-present) it has been incorporated into a larger "Arrive Ready to Study Life Science" course combining several modules of interest to life science students into a single, streamlined course with peer mentorship and study groups. In addition to the chemistry content, academic skills building, such as note-taking, reading and annotating, critical writing, and test preparation, and biology modules are provided. Over four years, there have been a total of 3230 participants.

Arrive Ready to Study Life Science runs for four weeks with asynchronous material presented through our learning management system. While much of the material is asynchronous, students are also supported by upper year peer mentors, a weekly drop-in session with a Chemistry teaching assistant, and a panel discussion with faculty members. The chemistry content is organized around four self-assessments (through the quiz function in the learning management system). Students are directed to start with the assessments to help them gauge their level of high school preparation. Any incorrect answers provide instant feedback with a link to a resource page on that topic. This organization reduces the amount of time students spend working through the high school material by helping them to identify topics they need to review. Each resource page includes a short video and links to external resources for further information. In each video, the topic is introduced and then example problems are solved using a tablet to make the problem solving visible.

In Summer 2020, students were surveyed extensively about their Arrive Ready experience. When asked to summarize the course in three words, most students reflected positively on the experience, describing the course as “helpful”, “organized”, and “informative”. Despite these positive responses, a relatively small numbers of students complete all the self-tests, about 100 students compared to an enrollment of about 1900 students. Surveyed students have indicated a mix of reasons for the lack of participation, including that they were unaware of the program (24%), did not have time with work and family commitments (34%) and, did not want to study in the summer (9%).

This review content has also been added to our first-year course learning management system in recognition that students are particularly anxious about their high school background with COVID-19 disruptions and that not all student participated in the Arrive Ready program. Informal feedback suggests that students have found access to these resources useful, and they have expressed appreciation about having access throughout the semester. In the future, we will advertise content to students in a more targeted fashion (i.e. reminding students of the exponents and log videos when using those operations for the first time in the kinetics unit) to further support students.

If you are interested implementing a similar program at your institution and would like more detailed information, please feel free to contact me at kristine.quinlan@utoronto.ca.

Chemistry and Inuit Life & Culture: Making Chemistry Relevant

Geoff Rayner-Canham (v7grc@mun.ca) Memorial University, Grenfell Campus, Corner Brook, NL
Chaim Christiana Andersen, **Rosalina Naqitarvik**, and **Debbie Wheeler**

Making chemistry relevant is key to exciting students about the subject. For example, Jack Holbrook has commented [1]: "*Generalising, chemistry curricula tend to put the subject first, and applications a poor second. Forgotten is that relevancy is in the processes and products we utilise in society, and only afterwards in the understanding* …" In our view, relevancy is absolutely crucial if we chemistry instructors are to appeal to Indigenous students.

Our focus has been on links between chemistry and the Inuit way of life. One-third of Canada consists of Inuit lands: Nunavut, Nunatsiavut, Nanavik, and Inuvialuit. As a first step, from 2017 until 2022, Geoff Rayner-Canham (GRC) worked with two Inuk science students, Chaim Christiana Andersen (CCA) of Nunatsiavut and Ms. Rosalina Naqitarvik (RN) of Nunavut, to explore links between chemistry and the underpinnings of the Inuit way of life.

This fascinating investigation resulted in a series of articles in a special issue of the magazine *Chem13 News* "Chemistry and Inuit life & Culture" [2], the articles being titled (with author initials) as follows:

Ramah Bay – 7,000 Years of Aboriginal Culture – and Chemistry (CCA & GRC)

Soy Sauce – an Essential Inuit Condiment (CCA & GRC)

PFOS: the Newest Arctic Pollutant (CCA & GRC)

Sea Ice: Essential for northern survival (CCA & GRC)

The Ulu: Chemistry and Inuit women's culture (CCA & GRC)

Chemistry of the Cure: Case Studies of Some Inuit Remedies (CCA & GRC)

The Arctic Atmosphere: Unique and Amazing (CCA & GRC)

Snow: Making Life Possible in the Arctic (CCA & GRC)

Living on the Edge: Some Chemistry of the Inuit Diet (RN, CCA & GRC)

Composites in Inuit Life: What was Old is New Again (RN & GRC)

The Land beneath our Feet: Inuit Rock of Ages (RN & GRC)

Climate Change: Our way of life will change, our culture will survive (RN)

The series has stimulated at least Canadian grade school science teachers to incorporate some of the Inuit context into their own chemistry and science teaching [3].

Memorial University has a non-prerequisite on-line course *Chem 1900: Chemistry and Everyday Life*, and Debbie Wheeler and Geoff Rayner-Canham worked together to incorporate some of the topics from the *Chem13* series, plus others that they devised, into the course content. Serendipitously, they were first asked to teach the Inuit-contextualized version to a class of Inuit B.Ed. primary-elementary students studying at Nunavut Arctic College. The Inuit-relevant topics and their context are listed below.

Nunavut diamond mining; The Ulu (atomic structure).

CO_2, CH_4, and climate change (covalent bonding).

Dinosaurs in the Arctic; Aurora (atmospheric chemistry)

Arctic snowmobile oil (hydrocarbons)

PFOS and the grasshopper effect (organic functional groups)

Snow and the Iglu (intermolecular forces)

Soapstone and the qulliq (ionic bonding)

What doesn't fit in ice and what does (solutions)

Arctic char and soy sauce; Vitamins and minerals in the Inuit diet (food chemistry)

Clothing in the Arctic (polymer chemistry)

Remedies from the Land (pharmaceutical chemistry)

Rock of ages (nuclear chemistry)

The Feedback from the class was consistently positive, these two comments being representative:

Comment 1: *I am excited about taking the chemistry course, especially because our Inuit culture will be incorporated into the course! Our Inuit culture and tradition are very important to me, especially our language so I am happy they will be incorporated.*

Comment 2: *I want to show appreciation to the instructors for trying their best to put Inuit relevance in our weeks content. To me, it shows that we are appreciated as students. I love when us Inuit and our culture feels included. Ill never forget your support and Kindness.*

To contribute to Memorial University's course-indigenization pledge, the Inuit segments were then retained for Memorial University classes. The response from these students was also unanimously positive:

Comment 1: *I believe that having the Inuit features incorporated into each week's reading is a great way to honour the Inuit culture in our country. Not only does it provide interesting examples of how chemistry is all around us in our everyday lives, but it is also an opportunity to learn more interesting facts about Inuit people and their culture. The Inuit features quickly became my favourite part of the weekly course readings and I can't wait to learn more in the coming weeks!*

Comment 2]: *The Inuit features in this course are very important in my opinion. I think learning about Inuit culture is essential to [us] as Canadians. These course features allow us to understand specific aspects of Inuit culture and life that can be related through chemistry.*

In Conclusion

Take-away 1: There is so much talent among Indigenous students! If we are to nurture future generations of scientifically-educated Inuit, First Nations, and Métis, then it is incumbent as chemistry educators to collaborate with Indigenous representatives to develop relevant teaching materials.

Take-away 2: It is important that our non-Indigenous students come to appreciate the science – especially chemistry – underpinning aspects of life in Indigenous societies by means of incorporating such materials in our regular chemistry courses.

References

1. J. Holbrook, "Making Chemistry Teaching Relevant," *Chem Ed. International*, 2005, **6**(1), 1-12.

2. C. C. Andersen, R. Naqitarvik, and G. Rayner-Canham, "Chemistry and Inuit Life and Culture," *Chem13 News*, Fall 2022 Special edition, https://uwaterloo.ca/chem13-news-magazine/

2. C. C. Andersen, R. Naqitarvik, J. Winters, E. Taylor, G. Rayner-Canham, "Making chemistry relevant to Indigenous Peoples: An Inuit case study," *The Science Teacher*, in press (2024), https://doi.org/10.1080/00368555.2024.2385890.

50TH COLLEGE CHEMISTRY CANADA (C3) CONFERENCE – 2024

May 24-26, 2024, Trent University, Peterborough, ON

Figure 1: Attendees of the 50th anniversary College Chemistry Canada (C3) conference in their 50th anniversary hoodies along the banks of the Otonabee River.

The 2024 C3 conference hosted at Trent University marked the celebration of the 50th anniversary C3 conference. The event was boasted beautiful weather, wonderful friends, and engaging chemistry discussions.

The opening Friday saw daytrips that highlighted the importance of the Otonabee River and Trent Severn waterway to the region of Peterborough and the Kawarthas. Attendees enjoyed a trip to the Canadian Canoe Museum as well as a river cruise through the Otonabee River, with the highlight being the Peterborough Lift Lock, the world's highest hydraulic lift lock situated 65 feet above the city.

The conference program as well as photo highlights from throughout the weekend can be found on the 2024 conference webpage. As always, thank you to Bill Blann for acting as the official unofficial conference photographer and paparazzo.

Figure 2: The main entryway to the Canadian Canoe Museum main gallery.

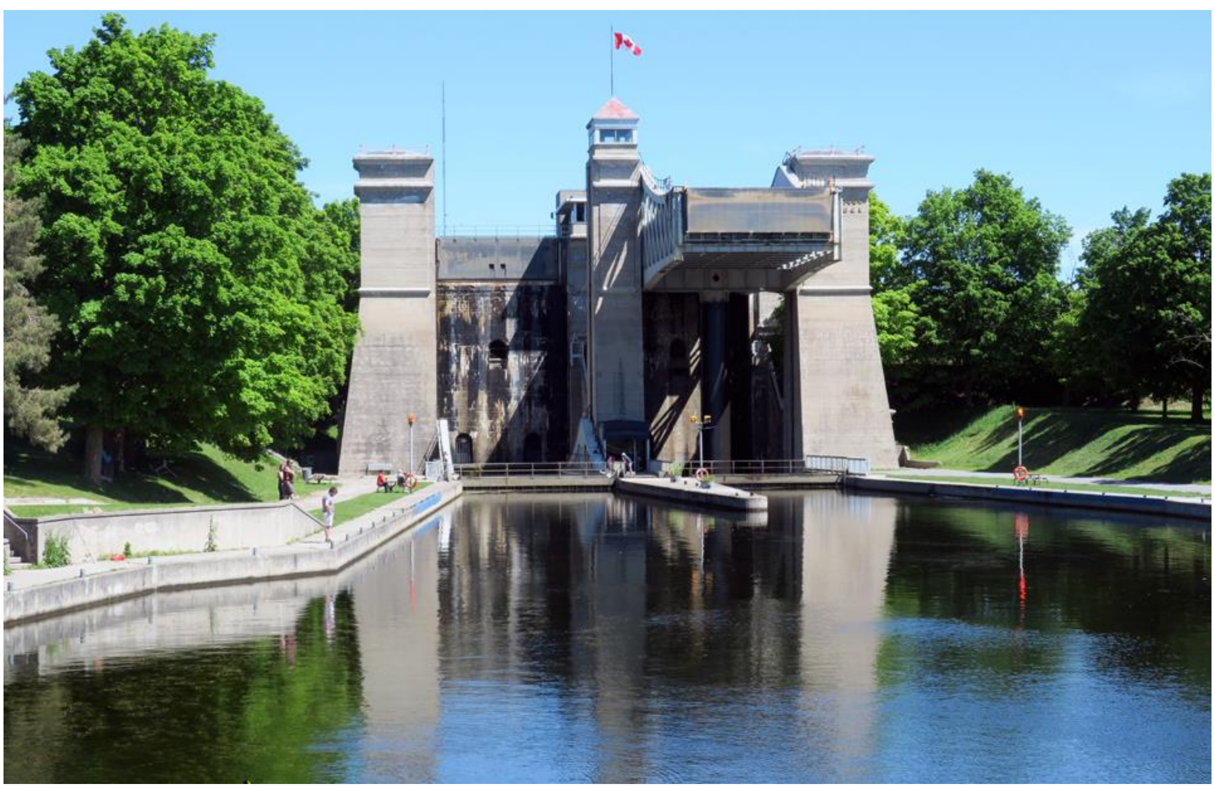

Figure 3: The Peterborough Lift Lock, the world's highest hydraulic lock system.

51ST COLLEGE CHEMISTRY CANADA (C3) CONFERENCE – 2025

May 23-25, 2025, Simon Fraser University, Burnaby, BC

SFU SIMON FRASER UNIVERSITY

51st College Chemistry Canada Conference

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