SCH 3U
Grade 11 University Chemistry
Course outline/ expectations

Purpose: to cover all aspects of the Ontario curriculum and provide sufficient **depth** as a **starter course for Advanced Placement** Chemistry program and preparation for the University of Waterloo Avogardo contest.

Since this is a starter course for Chemistry, a greater focus will be placed on research projects devoted to applying chemical concepts to daily living.

The fundamental question Grade 11 chemistry tries to answer :

How basic laboratory and thinking skills can be developed for practice in everyday living.

Topics covered: (in sequence)

A lot of correspondence in this course will occur online via email

Time schedule	Material covered
Week 1 to 2.5 (1.5 weeks)	**Naming compounds:** • Chemical of ionic, molecular and Transition metal species. • Polyatomic anions • Reading off vital information off the p-table • 1 day training in reading MSDS sheets & lab-ware identification **Quiz:** Chemical nomenclature **Equipment use training (1 day)** • Students will learn how to use pipettes, burettes, do a proper titration set-up, tare weighing balances, do proper emergency and regular clean-up of lab stations. • Students will be allowed to choose their lab groups/ partners and station which they will work at for the rest of the year. • After training, students **Quiz 2:** Lab-ware identification + safety test

Week 2.5 to 4.5 (2 weeks)	**The mathematics of chemistry: Units** • Significant figures: what are they are why are they important ? • A review of Exponential (Scientific) notation • Introduction to units of mass, pressure, temperature, volume, density, Avogardo's number, the mole • Atomic number, mass number calculations **Theories of the atom + orbital filling + electron configuration:** • Rules of orbital filling: Aufbau, Hund's and Pauli's principles • What are s, p, d and f orbitals • Principal, secondary quantum numbers • Writing electronic configuration of normal versus Transition elements- charged and neutral (2 days) • Isoelectronic species **Test:** Unit analysis + atomic # (10 multiple choice) questions 3 multiple choice on the 3 principles of orbital filling 2 multiple choice questions on quantum numbers 4 questions on electronic configuration of neutral and charged species.
Week 4.5 to 6 (1.5 weeks)	**Chemical bonding + melting, boiling points** • Drawing Lewis dot diagrams + VSEPR shapes • Learn how to read off VSEPR shapes chart • Ionization energy, size of (+) and (-) species , electronegativity (basic definitions) • Electronegativity differences and how they relate to polarity • Crystal lattice, metallic bonding (sea of electrons), network covalent solids • What determines melting/ boiling points • 3 types of intermolecular forces (London, Dipole ^{2} and H-bonding) **Lab:** Evaporation of liquids (Lab 9) **Test:** 5 Lewis/ VSEPR counting questions + Forces in a chart format 3 Chemistry contest questions on I.E, electronegativity and size of (+) and (-) species 1 TIPS question whereby students need to explain differences

	in melting and boiling points of different substances.

Week 6, 7.5 (2.5 weeks)	**<u>Balancing chemical reactions & identifying their types:</u>** • Writing Net ionic equation and identifying spectator ions (essential for tackling AP questions) • Types of reactions to be studied: Combustion, synthesis, decomposition, single and double displacement, neutralization, redox. • Balancing redox equations in acid and basic conditions (the basics) • The activity series and how it applies to the reactivity of metals • Endo and exothermic reactions **<u>Lab 1:</u>** Deriving your own activity series of metals via SD reactions **<u>Lab 2:</u>** Finding the Δ H of combustion of Mg + HCl (using temperature probe) (Lab 19) **<u>Lab 3:</u>** Qualitative analysis (precipitation lab) (modified simpler version of AP lab exam question) **Students will take careful note of the color of each precipitate and write all equations in NIE format (as required by AP).** **<u>Lab 4:</u>** Making esters (done on a Friday for fun ☺)
Week 7.5 to 10. 5 (3 weeks)	**<u>The mole and stoichiometric calculations :</u>** • Finding molar mass • Finding # of moles **<u>Lab:</u>** Calculating # of moles (Ms. Ng lays out different containers of substances each with a mass on it. Students move around stations to find # of moles of substance in each container)

Week 7.5 to 10.5 continued (3 weeks)	Student will learn how to criss-cross in a chart format for : • Mole to mole relationships • Mole to mass relationships **Quiz:** Setting up ratio chart for mole & mass calculations • Limiting reagents (LR) • Calculating excess • Nasty contest questions pertaining to LR and excess **Quiz**: on finding LR and excess (2 questions taken from Avogardo contest) • % yield **Lab 1:** Making Slime (determining LR and excess) **Lab 2**: Making chalk (find % yield)
Week 10.5 to 12	**Empirical and molecular formula and % composition:** • finding % composition of common drugs Ms. Ng shall teach 1 lesson on "Google" skills (how to use the internet for proper research and citation), use ChemDraw and Mathtype to present a classy lab report. • **Research ISU:** Ms. Ng assigns each student a different penicillin, sulfa drug, anti-inflammatory or MAO inhibitor to research and present **(worth 5 % of final mark)** Students will need to learn about the reaction mechanism of these drugs as they interact/ bind to our body • Students will write a 2 page report (inserted into a template given out by Ms. Ng) • The report must be typed and printed / emailed (Ideas taken from Applied Chemistry, William R. Stine) **Lab**: Making Aspirin (find % yield) • Calculating empirical and molecular formulas (2 days)

	• 2 days review on Stoichiometry, LR, % yield, empirical, molecular formula, % composition **Test:** Split into 2 parts Part A: % composition, empirical and molecular formulas Part B: Limiting reagent and excess calculations, % yield (questions will be taken from old Avogardo contests or AP book)
Week 12	**Concentration and solubility :** • Learning how substances dissolve and what factors affect solubility. • Definition to know: solute, solvent, saturated, unsaturated, supersaturated. • $C = \frac{n}{v}$ (on ppm, % m/v) **Lab:** Making a solution (Ms. Ng will assign each student to make a specific concentration for a solution. Students need to show proper calculations and do the right dilutions for marks) • Finding concentration of a solution when mixed.
Week 13 to 14.5	**Acids and bases:** • 3 acid-base theories: Arrhenius, Bronsted-Lowry, Lewis • recognizing conjugate acid and bases • finding pH, pOH.. can pH be (-) and above 14 ? • finding overall pH when mixing strong acid with strong base. • Basic understanding of indicators and which to use **Lab:** Acid-base titration (making $(NH_4)_2SO_4$) , plot titration curve with pH probe-ware **STSE:** Why is regulation of soil pH so important ? (p. 341 Stine) The dangers of NH_4NO_3 (p 345 Stine)

	Test: 1 Concentration and dilution combined problem 1 acid-base mixture, finding pH combined question 3 multiple choice theory questions

Week 14.5 to 15. 5 (3 days)	**Nuclear decay:** • Alpha, beta, gamma decay + balancing nuclear reaction equations • Nuclear fission/ fusion (transmutation of elements) • STSE: Biological effects of radiation We will focus on the effects of : (reading assignments) • Radon testing • C- 14 dating in archeology • Isotopic tracers used in medicine • Nuclear power generation (Chernobyl + 3 Mile Island)
Week 15 to 16.5	**STSE: Air chemistry** (reading assignments, in-class discussions) • What chemicals constitute polluted air ? (Chapter 14) CO, NO, SO_2 , O_3 , CO_2 • Greenhouse effect • Ozone loss • Smog and CFCs **Trip to York University**
Week 16.5 to 17.5	**Gas Laws:** • 3 gas laws --> PV = nRT • determining MW of a gas • practice with contest "gas" questions **Lab:** Determination of R, the gas constant
Week 18	**Review week** • Review package 1 to 4 • Collated contest questions (for homework over the weekend)

Evaluation scheme:

All tests, quizzes will be split into 4 categories, KU, TIPS, APP, C, each weighted equally at 25 %

Test, quizzes :	30% of final mark	(Tests and quizzes have equal weighting)
Lab skill/ clean-up :	**10 % of final mark**	
Lab reports :	20 % of final mark	
Assignment:	10 % of final mark	
Exam (written)	30 % of final mark	

** if you don't clean-up after your group, you get "ZERO" for your group.

*** All marks will be posted regularly on Ms. Ng's website http:// www.eClassInfo.com/home.asp?id=RSYNg

Things you need to know to do well in this course :

All material from :

1. **Ms. Ng's notes and practice exercises on CD**

   ** All exercises on the CD are expected to be completed and handed in to Ms. Ng on the date stated.

2. **Extra material sent via email from Ms. Ng**

   **** Students are responsible for studying from all notes and websites suggested by Ms. Ng via email.

3. **Any extra worksheets and practice exams handed out in class.**