



**DEPARTMENT OF ACADEMIC UPGRADING  
COURSE OUTLINE Fall 2019**

**CH0120 (A2/B2): Chemistry Grade 11 Equivalent 5(4-0-2.0)**

6.0 hours/week for 15 weeks (90 hours)

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<b>Office Hours:</b>	by appointment		

**CALENDAR DESCRIPTION:** Major concepts include: inorganic nomenclature; atomic structure, orbitals; ionic and covalent bonding, hydrogen bonding, metallic bonding, Van der Waal forces, ionization, electronegativity, VSEPR; solutions, stoichiometry, empirical formulas, percent composition, pH, molarity, equilibrium, Arrhenius acids and bases.

**PREREQUISITES/COREQUISITE(S):** SC0110 (Science 10) within the last two years; MA0110 (Math 10C) or MA0120 placement. See also Academic Upgrading Science Requirements.

**REQUIRED TEXT/RESOURCE MATERIAL:**

Nelson Chemistry (Alberta 20-30)

Chemistry Data Booklet (colour copies in the bookstore, or can be printed from Moodle)

Lab coat

Graph Paper (fine lined 10 lines/cm-may be printed from Moodle).

**DELIVERY MODE(S):** Classroom instruction and lab. Moodle will be used extensively.

**COURSE OBJECTIVES:**

*Students will:*

**Unit A: Quantitative Relationships in Chemical Changes:**

- explain how balanced chemical equations indicate the quantitative relationships between reactants and products involved in chemical changes.
- use stoichiometry in quantitative analysis

**Unit B: Forms of Matter: Gases**

- explain molecular behavior, using models of the gaseous state of matter.

**Unit C: Matter as Solutions, Acids and Bases**

- investigate solutions, describing their physical and chemical properties
- describe acidic and basic solutions qualitatively and quantitatively

**Unit D: The Diversity of Matter and Chemical Bonding**

- describe the role of modelling, evidence and theory in explaining and understanding the structure, chemical bonding and properties of ionic compounds
- describe the role of modelling, evidence and theory in explaining and understanding the structure, chemical bonding and properties of molecular compounds.

**LEARNING OUTCOMES:** Please see detailed course outline, which follows.

**TRANSFERABILITY:**

Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability.

**\*\*Although 50% (D) is considered a pass for this course, it is strongly recommend that you achieve a mark of 65% (C) to be successful in Chemistry 30.**

**EVALUATIONS:** Course final grade will be based on the following components.

Unit Tests (equally weighted)	40%	
Labs	15%	<b>Late penalty 20% per day for 2 days.</b>
Assignments, Quizzes	15%	<b>Late penalty 20% per day for 2 days.</b>
Final Exam (Cumulative)	30%	

All tests and exams **MUST** be written at the scheduled times unless **PRIOR** arrangements have been made with the instructor. A missed test (exam) will result in a score of ZERO on that test (exam). Only in very specific cases may student be given an opportunity to make up a missed exam (student will be presented with a different version of the exam). Doctor, lawyer or police documentation may be required. The final exam is 3 hours long and is scheduled by the registrars' office during GPRC Exam weeks. Do not book vacation in this time period.

**GRADING CRITERIA:** Final Grades will be assigned on the Letter Grading System.

Alpha Grade	4-point Equivalent	Percentage Guidelines	Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	90-100	C+	2.3	67-69
A	4.0	85-89	C	2.0	63-66
A-	3.7	80-84	C-	1.7	60-62
B+	3.3	77-79	D+	1.3	55-59
B	3.0	73-76	D	1.0	50-54
B-	2.7	70-72	F	0.0	00-49

**Labs:**

- Attendance is compulsory in all labs.
- Missed labs result in a score of zero. **There are NO make-up labs.**
- In particular, you must attend the Lab Safety and Orientation. If you miss it, you will be excluded from participating in the lab component of the course.
- If you are late and have missed the lab safety discussion, you may be excluded from participating in the lab and will receive a mark of zero.
- **Lab reports are due \_\_\_\_\_ following the lab.** Late lab reports will result in a penalty of 20% per day. Labs over two days late will not be graded without PRIOR approval.
- These are formal lab reports. Follow the detailed instructions in your lab manual and on Moodle to ensure that you are doing them correctly. Think of them as the science equivalent to an essay and be prepared to put in as much time and detail into preparing them.
- Although the lab component of the course is only worth 15% of your final mark; if you fail the lab, you fail the course.

**Lab Schedule will be provided as part of your course timeline.**

**STUDENT RESPONSIBILITIES:**

Refer to the College Policy on Student Rights and Responsibilities at

[https://www.gprc.ab.ca/files/forms\\_documents/StudentRightsandResponsibilities.pdf](https://www.gprc.ab.ca/files/forms_documents/StudentRightsandResponsibilities.pdf)

The Academic Upgrading Department is an adult education environment. Students are expected to show respect for each other as well as faculty and staff. Students are expected to participate fully in achieving their educational goals.

Certain activities are disruptive and not conducive to an atmosphere of learning. In addition to the *Student Rights and Responsibilities* as set out in the College calendar, the following guidelines will maintain an effective learning environment for everyone. We ask the cooperation of all students in the following areas of classroom department.

1. Regular attendance is expected of all students, and is crucial to passing this course. Students who miss classes will soon find themselves falling behind and failing. Lateness will **not** be tolerated as it interrupts the instructor and fellow classmates.
2. Check **Moodle** as well as **GPRC email** on a regular basis. Any changes to the Course Timeline or Exam Dates will be communicated on Moodle. Students will be held to the deadlines listed on the Course Timeline whether or not those

deadlines are spoken about in class.

3. As per Department Policy, if you miss more than 10 per semester of classes in any course, you may be debarred from the final exam for that course.
4. A certificate (a doctor's or a note from the funeral home) will be required to make up the midterm or final exam. **You will receive a grade of F if you miss the final.** Call if you are going to miss a test. There may be a deduction of 10% for test rewrites.

**\*\*\*Very important:**

**Laboratory attendance to each specific experiment is compulsory; a passing grade in the laboratory component is required to pass the course.** There are NO 'make up' labs in this course. Being absent from an experiment will result in a grade of **ZERO** for that experiment. If you fail the lab component of the course, you fail the course.

Lab reports must be submitted on the required date and at the **required time**.

Assignments will not be accepted after the assignment has been returned to the class.

Penalties for late **lab reports/assignments** are as follows: 24 hours - 20%, 48 hours - 40 %, anything after that is a zero. These penalties only apply until I hand back reports or assignments to the class (which may happen the next day if an exam is approaching).

Recommendations for success:

- Review material that is prerequisite to this course quickly so it does not slow you down.
- Complete all pre class and pre-lab assignments before arriving in class.
- Keep up with course material.
- Put away your phone!!! The average mark of people more interested in their phone than the class was 35%.
- If you are experiencing difficulties with course material, get help immediately.
- Catch up on missed material before the next class.
- Provide documentation for missed midterms or finals.
- Be aware of penalty for failing the lab component and not writing the final.

#### STATEMENT ON PLAGIARISM AND CHEATING:

Cheating and plagiarism will not be tolerated and there will be penalties. For a more precise definition of plagiarism and its consequences, refer to the Student conduct section of the College Calendar at:

[https://www.gprc.ab.ca/files/forms\\_documents/Student\\_Misconduct.pdf](https://www.gprc.ab.ca/files/forms_documents/Student_Misconduct.pdf)

Instructors reserve the right to use electronic plagiarism detection services on written assignments. **Instructors also reserve the right to ban the use of any form of electronics (cell phones, Blackberries, iPods, tablets, scanning pens, electronic dictionaries, etc.) during class and during exams.**

\*\*Note: all Academic and Administrative policies are available on the same page.

#### Additional Information (Optional):

\*\*Note: all Academic and Administrative policies are available at <https://www.gprc.ab.ca/about/administration/policies/>

### CHEMISTRY 0120 DETAILED COURSE OUTLINE AND LEARNING OBJECTIVES

#### UNIT A: QUANTITATIVE RELATIONSHIPS IN CHEMICAL CHANGES

Key Concepts:

- chemical reaction equations
- spectator ions
- precipitation
- actual, theoretical and percent yield
- end point
- titration curves for strong acids and bases
- net ionic equations
- reaction stoichiometry
- limiting and excess reagents
- titration
- equivalence point

**General Outcome 1: Students will explain how balanced chemical equations indicate the quantitative relationships between reactants and products involved in chemical changes.**

A11 predict the product(s) of a chemical reaction based upon the reaction type

A12 recall the balancing of chemical equations in terms of atoms, molecules and moles

A13 contrast quantitative and qualitative analysis

A14 write balanced ionic and net ionic equations, including identification of spectator ions, for reactions taking place in aqueous solutions

A15 calculate the quantities of reactants and/or products involved in chemical reactions, using gravimetric, solution or gas stoichiometry.

**General Outcome 2: Students will use stoichiometry in quantitative analysis.**

A21 explain chemical principles (i.e., conservation of mass in a chemical change), using quantitative analysis

A22 identify limiting and excess reagents in chemical reactions

A23 define theoretical yields and actual yields

A24 explain the discrepancy between theoretical and actual yields

A25 draw and interpret titration curves, using data from titration experiments involving strong monoprotic acids and strong monoprotic bases

A26 describe the function and choice of indicators in titrations

A27 identify equivalence points on strong monoprotic acid–strong monoprotic base titration curves and differentiate between the indicator end point and the equivalence point.

**UNIT B: FORMS OF MATTER: GASES**

Key Concepts

- Celsius and Kelvin temperature scales
- ideal gas law
- standard ambient temperature and pressure (SATP)
- real and ideal gases
- Charles's law
- Boyle's law
- standard temperature and pressure (STP)
- absolute zero
- law of combining volumes

**General Outcome 1: Students will explain molecular behaviour, using models of the gaseous state of matter.**

B11 describe and compare the behaviour of real and ideal gases in terms of kinetic molecular theory

B12 convert between the Celsius and Kelvin temperature scales

B13 explain the law of combining volumes

B14 illustrate how Boyle's and Charles's laws, individually and combined, are related to the ideal gas law ( $PV = nRT$ )

- express pressure in a variety of ways, including units of kilopascals, atmospheres and millimetres of mercury
- perform calculations, based on the gas laws, under STP, SATP and other defined conditions.

**UNIT C: MATTER AS SOLUTIONS, ACIDS AND BASES**

Key Concepts

- homogeneous mixtures
- electrolyte/nonelectrolyte
- dilution
- weak acids and bases
- monoprotic/polyprotic base
- indicators
- hydroxide ion/pOH
- solubility
- concentration
- strong acids and bases
- monoprotic/polyprotic acid
- Arrhenius (modified) theory of acids and bases
- hydronium ion/pH
- neutralization

**General Outcome 1: Students will investigate solutions, describing their physical and chemical properties.**

C11 recall the categories of pure substances and mixtures and explain the nature of homogeneous mixtures

C12 provide examples from living and nonliving systems that illustrate how dissolving substances in water is often a prerequisite for chemical change

C13 explain dissolving as an endothermic or exothermic process with respect to the breaking and forming of bonds

C14 differentiate between electrolytes and nonelectrolytes

C15 express concentration in various ways; i.e., moles per litre of solution, percent by mass and parts per million

C16 calculate, from empirical data, the concentration of solutions in moles per litre of solution and determine mass or volume from such concentrations

C17 calculate the concentrations and/or volumes of diluted solutions and the quantities of a solution and water to use when diluting

C18 use data and ionization/dissociation equations to calculate the concentration of ions in a solution

C19 define solubility and identify related factors; i.e., temperature, pressure and miscibility

C110 explain a saturated solution in terms of equilibrium; i.e., equal rates of dissolving and crystallization

C111 describe the procedures and calculations required for preparing and diluting solutions

**General Outcome 2: Students will describe acidic and basic solutions qualitatively and quantitatively**

C21 recall International Union of Pure and Applied Chemistry (IUPAC) nomenclature of acids and bases

C22 recall the empirical definitions of acidic, basic and neutral solutions determined by using indicators, pH and electrical conductivity

C23 calculate  $H_3O^+_{(aq)}$  and  $OH^-_{(aq)}$  concentrations and the pH and pOH of acidic and basic solutions based on logarithmic expressions; i.e.,  $pH = -\log[H_3O^+]$  and  $pOH = -\log[OH^-]$

C24 use appropriate Système international (SI) units to communicate the concentration of solutions and express pH and concentration

answers to the correct number of significant digits; i.e., use the number of decimal places in the pH to determine the number of significant digits of the concentration

C25 compare magnitude changes in pH and pOH with changes in concentration for acids and bases

C26 explain how the use of indicators, pH paper or pH meters can be used to measure  $\text{H}_3\text{O}^+(\text{aq})$

C27 define Arrhenius (modified) acids as substances that produce  $\text{H}_3\text{O}^+(\text{aq})$  in aqueous solutions and recognize that the definition is limited

C28 define Arrhenius (modified) bases as substances that produce  $\text{OH}^-(\text{aq})$  in aqueous solutions and recognize that the definition is limited

C29 define neutralization as a reaction between hydronium and hydroxide ions

C210 differentiate, qualitatively, between strong and weak acids and between strong and weak bases on the basis of ionization and dissociation; i.e., pH, reaction rate and electrical conductivity

C211 identify monoprotic and polyprotic acids and bases and compare their ionization/dissociation.

## Unit D CHEMICAL BONDING – EXPLAINING THE DIVERSITY OF MATTER

Key Concepts:

- chemical bond
- covalent bond
- polarity
- intramolecular and intermolecular forces
- electron dot diagrams
- valence-shell electron-pair repulsion (VSEPR) theory
- ionic bond
- electronegativity
- valence electron
- hydrogen bond
- Lewis structures

**General Outcome 1: Students will describe the role of modelling, evidence and theory in explaining and understanding the structure, chemical bonding and properties of ionic compounds.**

D11: recall principles for assigning names to ionic compounds

D12: explain why formulas for ionic compounds refer to the simplest whole-number ratio of ions that result in a net charge of zero

D13 define valence electron, electronegativity, ionic bond and intramolecular force

D14 use the periodic table and electron dot diagrams to support and explain ionic bonding theory

D15 explain how an ionic bond results from the simultaneous attraction of oppositely charged ions

D16 explain that ionic compounds form lattices and that these structures relate to the compounds' properties; e.g., melting point, solubility, reactivity

**General Outcome 2: Students will describe the role of modelling, evidence and theory in explaining and understanding the structure, chemical bonding and properties of molecular substances.**

D21: recall principles for assigning names to molecular substances

D22 explain why formulas for molecular substances refer to the number of atoms of each constituent element

D23 relate electron pairing to multiple and covalent bonds

D24 draw electron dot diagrams of atoms and molecules, writing structural formulas for molecular substances and using Lewis structures to predict bonding in simple molecules

D25 apply VSEPR theory to predict molecular shapes for linear, angular (V-shaped, bent), tetrahedral, trigonal pyramidal and trigonal planar molecules

D26 illustrate, by drawing or by building models, the structure of simple molecular substances

D27 explain intermolecular forces, London (dispersion) forces, dipole-dipole forces and hydrogen bonding

D28 relate properties of substances (e.g., melting and boiling points, enthalpies of fusion and vaporization) to the predicted intermolecular bonding in the substances

D29 determine the polarity of a molecule based on simple structural shapes and unequal charge distribution

D210 describe bonding as a continuum ranging from complete electron transfer to equal sharing of electrons.