

Department of Physical Sciences (Chemistry)

CHEM 1520 – 3 Credits
Principles of Chemistry (3,0,3)(L) (EN1)
Winter 2019

Instructor: Dr. Nelaine Mora-Diez
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Office Hours: Mon, Wed, Fri 2:30 – 3:30 pm
Additional office hours are available by appointment.

Description

CHEM 1520 is the second half of first-year chemistry designed for students with a strong background in chemistry. The Department of Chemistry defines a strong background as at least a B in Chemistry 12 or CHEM 0600; however, the course is available to any student with CHEM 1500 and Chemistry 12 or CHEM 0600. This course, in combination with CHEM 1500, will serve as a prerequisite for second year Chemistry courses at TRU and other BC institutions.

The course topics include (1) gases, (2) thermochemistry, (3) kinetics, (4) acid-base equilibrium, (5) buffers, titrations and solubility equilibrium, and (6) entropy, free energy and electrochemistry. Students will become familiar with all these topics during the course. The laboratory stresses basic precision techniques in quantitative analytical chemistry as well as the use of analytical instrumentation and experiments in physical chemistry.

This section is mainly for students registered in the Engineering program.

Prerequisites

Chemistry 12 or CHEM 0600 (a grade of B or better is recommended) and acceptance in to the TRU Engineering program.

Lectures

Mon, Wed, Fri 1:30 – 2:20 pm S 373

Laboratory

A three-hour laboratory session per week is required. See details below.

Assessment

This one-semester course is worth 3 credits. A letter grade will be awarded for CHEM 1520 using the Grading System (Policy ED-3-5) from the Policy website at: <http://www.tru.ca/policy/allpolicy.html>

The winter semester final exam period is April 15-30. Students **must** be available to write an exam at any time during this period. **No special arrangements will be made.**

Grades will be assigned on the following basis:

Moodle quizzes [‡]	5%	
Term Test 1	15%	(Wed, Feb 13)
Term Test 2	15%	(Wed, Mar 27)
Laboratory	20%	
Final examination	45%	(Exam period: April 15-30)

[‡]**Moodle quizzes** can be done an unlimited number of times before the due date. The mark of your best attempt will be kept as your quiz mark in each case.

An aggregate total of at least 50% (37.5/75) must be achieved on the **sum** of the term tests and the final exam in order to receive a passing grade.

A total of 50% (10/20) must be achieved in the laboratory section to receive a passing grade in CHEM 1520. Students **must** complete at least 75% of the experiments and at least one laboratory exam to pass the lab. This requirement will **not** change even with a valid excuse. A grade of zero will be given for missed labs and term tests when appropriate reasons are not made clear to the instructor by the student for such absence.

Required Materials

Text: R. Chang and J. Overby, *Chemistry*, 13th Edition, McGraw-Hill, 2019.
Custom Publication for TRU; main first year text, available at the TRU Bookstore.

Laboratory Material: TRU CHEM 1520 Laboratory Manual Winter 2019 (students have the option to purchase the lab manual from the TRU Bookstore **or** download it from the lab Moodle site), carbonless copy laboratory notebook, safety goggles or safety glasses, lab coat.

Calculator: A non-programmable, single numeric line calculator is required, such as the Casio fx-260 (available at the bookstore) or equivalent. No electronic devices or dictionaries may be used on any closed-book Chemistry exam. Chemistry does not permit textual input calculators to be used on class or lab exams. We reserve the right to inspect any student calculator at any time.

Optional Materials

CHEM 1520 incomplete lecture notes and other useful course materials are available on Moodle. Enroll in the Moodle course “CHEM 1520 - Principles of Chemistry (Mora-Diez)” by using the enrolment key: 2019-CHEM1520.

To access Moodle on the Internet, use the Moodle quick link from the TRU homepage (www.tru.ca). Login instructions are available on the Moodle site.

Lab Rules & Additional Information

No student will be permitted to perform a laboratory experiment in any chemistry course without safety goggles and laboratory coat. These items are available for purchase at the bookstore.

Open toed shoes and earphones from personal music-playing devices are not permitted.

Any safety problems encountered by students must be reported to Stacey Jyrkkanen, Manager, TRU Health and Safety Department; 371-5805 or sjyrkkanen@tru.ca

Below is the schedule of experiments for the two lab rooms, S261 and S269 and the Grouping keys for the lab Moodle site. Students will need to self-enroll in the lab Moodle site.

Week	S261	S269
Jan 7 – 11	No labs	
Jan 14 – 18	Check-In and Safety	
Jan 21 – 25	SAFETY TEST & Exp 1: Ideal Gas Constant and Molar Volume of a Gas	
Jan 28 – Feb 1	Exp 2: Determination of the Heat of Formation of Magnesium Oxide	
Feb 4 – Feb 8	Exp 3: Dissociation Constant of Salicylic Acid	
Feb 11 – Feb 15	Exp 4: Carbon Dioxide Equilibrium	
Feb 18 – 22	No labs - Mid-Semester Break	
Feb 25 – Mar 1	Exp 5: Spectrophotometric Determination of an Indicator Equilibrium Constant – Methyl Red	Exp 7: Acid-Base Titration Curves and Buffer Systems PART A
Mar 4 – 8	Exp 6: Chemical Kinetics	Exp 7: Acid-Base Titration Curves and Buffer Systems PART B
Mar 11 – 15	Exp 7: Acid-Base Titration Curves and Buffer Systems PART A	Exp 5: Spectrophotometric Determination of an Indicator Equilibrium Constant – Methyl Red
Mar 18 – 22	Exp 7: Acid-Base Titration Curves and Buffer Systems PART B	Exp 6: Chemical Kinetics
Mar 25 – 29	Exp 8: Electrochemistry and the Nernst Equation	
Apr 1 – 5	LAB EXAM	

Course Name: **CHEM 1510 – 1520 LABORATORY**

Enrolment Key: (depends on day, time, and room # ... as listed below)

Moodle Groupings/Keys:

	Monday	Tuesday	Wednesday	Thursday	Friday
9:30 am – 12:20 pm				S269-04	
2:30 pm – 5:20 pm	S261-01 S269-01	S261-02 S269-02	S261-04 S269-03	S261-07 S269-05	S261-09
6:30 pm – 9:20 pm	S261-06	S261-03	S261-05	S261-08	

You must be registered in **one** of the lab sections. Most of you are already registered in the lab sections in S261 from 2:30 to 5:20 pm, Monday or Tuesday (S261-01 and S261-02).

This information is in your lab manual; however, some students may just want to access the manual from Moodle. **Labs begin the second week of classes**, so this information will also be presented during check-in.

Legal Stuff

It is the responsibility of all students to be aware of TRU Student Academic Policies, Regulations and Procedures. These include: Academic Honesty Policy ED-5-0; Appeals Policy ED-4-0; Attendance ED-3-1; and Exams Policy ED-3-9. Forms of Academic Dishonesty are summarized and described in the TRU Policy website at: <http://www.tru.ca/policy/allpolicy.html> and include cheating, misconduct, fabrication and plagiarism. **Students must write lab reports independently**, even when students work in pairs in a lab experiment.

TRU is a Scent Reduced Environment

Some students attending TRU have multiple chemical sensitivities which can lead to anaphylaxis. Anaphylaxis (anna - fill -axis) is a serious allergic reaction which can be life-threatening.

Although we cannot eliminate all scents and chemicals in a public setting, we are asking for your support and cooperation in reducing or eliminating your use of scented personal care products, such as perfume, cologne, after shave, cosmetics, hair spray/mousse, deodorant, scented soaps, etc.

The “Share the Air” website provides further information as well as suggestions for unscented alternatives for personal care products. Please review the website at:
<http://www.tru.ca/wellness/sharetheair.html>

Thank you very much for your attention to this serious issue. We appreciate your support as we all “Share the Air” at TRU!

Please contact the Disability Services Department if you have any questions.

Phone: 250-828-5023 • Toll Free: 1-888-828-6644 • Fax: 250-371-5772 • Email: dso@tru.ca

Course Content

(This outline may change as the course progresses)

Section 1: Gases

- 1.1. Gas properties and pressure
- 1.2. The gas laws
- 1.3. The ideal gas law: Applications
- 1.4. Dalton's law of partial pressures
- 1.5. The kinetic molecular theory of gases
- 1.6. Diffusion and effusion
- 1.7. Deviation from ideal behaviour

Section 2: Thermochemistry

- 2.1. Basic concepts
- 2.2. Enthalpy of chemical reactions
- 2.3. Calorimetry
- 2.4. Hess' law: Applications
- 2.5. Examples of enthalpy changes that refer to specific processes (self-study)

Section 3: Chemical Kinetics

- 3.1. The rate of a reaction
- 3.2. The rate law
- 3.3. The relation between reactant concentration and time
- 3.4. Activation energy and temperature dependence of rate constants
- 3.5. Reaction mechanisms
- 3.6. Catalysis

Section 4: Acid-Base Equilibrium

- 4.1. Acid-Base concepts
- 4.2. Acidity of a solution
- 4.3. Acid-base strength and equilibrium
- 4.4. Problems involving weak-acid and weak-base equilibria
- 4.5. Acid-base properties of salt solutions (Hydrolysis)
- 4.6. Lewis theory of acids and bases (self-study)

Section 5: Buffers, Titrations & Solubility Equilibria

- 5.1. Buffer solutions: pH calculations
- 5.2. Acid-base titrations
- 5.3. Solubility equilibria

Section 6: Entropy, Free Energy & Electrochemistry

- 6.1. Spontaneous and non-spontaneous processes
- 6.2. Entropy and entropy changes
- 6.3. The Gibbs free energy
- 6.4. Thermodynamics of redox reactions