COURSE CHEM 221
MATERIALS, SOLUTIONS AND INTERFACES

GENERAL INFORMATION

Course instructor	Dr. Jean-Michel Nunzi CHE 310, Chernoff Hall Phone: 36749 E-mail: nunzijm@queensu.ca
Lab instructor	Dr. Igor Kozin CHE 124, Chernoff Hall Phone: 36000, ext. 74665 E-mail: igor.kozin@chem.queensu.ca
Web site	Access **CHEM 221** OnQ space at: https://onq.queensu.ca/ active enrolment required.
Lectures	STIRLING RM B Schedule: Mon. 10:30-11:30; Wed. 09:30-10:30; Friday 08:30-09:30.
Office hours	**Friday. 09:30-11:30 – or by virtual appointment**
Required textbook	**Lectures**: P. Atkins, J. de Paula, *Physical Chemistry*, 11th, 10th or 9th Edition, W. H. Freeman & Co., New York **Tutorials**: P. Atkins, C. A. Trapp, M. P. Cady, C. Giunta, *Student Solutions Manual for Physical Chemistry*, 10th or 9th Edition, W. H. Freeman & Co., New York **Laboratory**: Laboratory Manual
Recommended software	MS Excel
Laboratory	**Monday 14:30 – 17:30** RM 210B
Laboratory	
Tutorials **Monday** **08:30 – 09:30**	CHERNOFF RM211 / RM 213 During tutorials, textbook problems will be solved step-by-step.
Marking	Laboratory reports: **25%** Quiz (2 × 10%): **20% in class 1st Quiz Feb; 2nd Quiz 2 March** Midterm examination: **25% 2h after mid-term** Final examination: **30% 3h exam end of term** Total **100%**

	A common equation sheet will append each quiz as well as the midterm and final examinations. You may use this equation sheet during the quizzes and the examinations. Students must pass BOTH the lecture/tutorial and the laboratory components to pass the course. Students must obtain a weighted average mark of OVER 50% on the written exams to pass the lecture/tutorial component. If a student does not pass the lecture/tutorial and the lab components of the course, they will fail the entire course. Students who do not attend all laboratory sessions may be assigned a grade of incomplete (IN) and be required to attend and pass the missed lab(s) the following year before the IN is cleared from their transcript.

COURSE OUTLINE

1. Overview of first law of thermodynamics
Overview of basic concepts learnt in the first-year chemistry course; Thermochemistry; State functions and exact differentials; ***Chapter 2 in all editions***. (4 lectures)
2. Overview of the second and third laws of thermodynamics
Direction of spontaneous change; Helmholtz and Gibbs energies; Combining the first and second laws; ***Chapter 3 in all editions***. (4 lectures)
3. Phase transitions and Simple mixtures
Phase diagrams; Thermodynamic aspects of phase diagrams; ***Chapter 4 in all editions***. (1 lecture)
Thermodynamic description of mixtures; Properties of solutions; Phase diagrams of binary systems; Activities; ***Chapter 5 in all editions***. (7 lectures)
4. Equilibrium electrochemistry
Half-reactions and electrodes; Varieties of cells; The cell potential; Standard electrode potentials; Application of standard potentials; ***Chapter 6 in all editions***. (3 lectures)
5. Solids
Crystallography; The properties of solids; ***Chapter 15 in the 11th, Chapter 18 in the 10th and Chapter 19 in the 9th edition***. (3 lectures)
6. Molecular interactions
Electric properties of molecules; Interactions between molecules; Gases and liquids; ***Chapter 14 in the 11th edition, Chapter 16 in the 10th and Chapter 17 in the 9th***. (2 lectures)
7. Molecules in motion (subject will be covered if time allows)
Molecular motion; Molecular motion in liquids; Diffusion; ***Chapter 16 in the 11th, Chapter 19 in the 10th and Chapter 20 in the 9th edition***.

Learning Outcomes

Students will know the basics of thermodynamics, 1st and 2nd principles, state functions, their meaning, and understand how to use them in a variety of contexts: Phase transitions, simple mixtures and equilibrium electrochemistry in particular. They will also know the properties of solids, how to measure them and they will understand how to bind these properties together using their atomic composition and organization. They will know how molecules interact together and understand how their properties can be calculated out of these interactions.

Using their course notes or an equation sheet, students will apply these properties to the resolution of simple problems which are representative of practical situations faced in a chemistry laboratory: from the understanding of characterization methods to the analysis of physicochemical relationships between atom and molecules and their properties. They will know how to deal with dimensions, units, and how to convert them.

Academic Integrity

Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility (see *www.academicintegrity.org*). These

values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities at: *http://www.queensu.ca/secretariat/policies/senateandtrustees/principlespriorities.html*.
Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 at: *http://www.queensu.ca/artsci/academic-calendars/2011-2012-calendar/academic-regulations/regulation-1* on the Arts and Science website (*http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity*), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions, which contravene the regulation on academic integrity, carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

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