JOHN ABBOTT COLLEGE COURSE OUTLINE

A. GENERAL INFORMATION:

1. Program name(s) (if applicable):	Science
2. Course title:	**General Chemistry I: The Chemistry of Solutions**
3. Course and section number(s):	202-NYB-05
4. Ponderation (weekly class – lab/fieldwork – homework hours):	3-2-3
5. Credits:	$2^2/_3$
6. Competency statement(s) and code(s):	To analyze the properties of solutions and reactions in solution (00UM) Covered completely
7. Prerequisite (if any):	Secondary V Chemistry
8. Semester:	
9. Teacher name(s), (pronouns if desired):	
10. Office number, phone extension (email address optional):	
11. Teacher's availability:	

B. INTRODUCTION (including any program-related information):

Course summary: Countless chemical processes take place in solution, including those of biological systems, industry and in the home. Studying and working with phenomena they can experience directly, and with which they are already somewhat familiar, students will be provided with a thorough description of the properties of solutions and the chemical processes that occur in them. The course encourages students to relate the chemistry they study to the world in which they live. The course also involves developing problem-solving strategies; the student will be given many opportunities to exercise logical deduction and mental discipline, and to appreciate the way simple mathematics is a fundamental part of chemical language.

Role and place of the course: It is typically taken in the program's first semester. A molecular-level rationale for the properties of solutions will be presented in General Chemistry II: Atomic and Molecular Structure, for which this course is a prerequisite.

C. COURSE OBJECTIVES:

Objectives: To describe and analyze properties of solutions and reactions that occur in solutions
1. Analyze the colligative properties of solutions.
2. Solve problems related to kinetics of reactions in solution.
3. Solve problems related to chemical equilibria.
4. Verify experimentally certain properties of solutions.
5. Determine experimentally some characteristics of reactions which occur in solutions.
Upon successful completion of this course, students will be able to: • make appropriate use of concepts, laws and principles; • use terminology appropriately; • show adequate understanding of chemical situations encountered; • demonstrate rigour and coherence in the use of problem-solving methods; • validate approximations when required; • design and/or apply correctly experimental procedures; • adhere to safety and environmental protection regulations; • discuss results logically; • estimate uncertainties; • present experimental results suitably.

D. EVALUATION PLAN (include all components of the evaluation and their weights – IPESA Article 6):

Evaluation type:	**%**	**Tentative date:**	**Link to competencies/objectives/ competency elements:**	**√ if part of final evaluation**
Unit I test	10	Week 5	3	
Unit II test	10	Week 10	1, 3	
Unit III test	10	Week 14	2	
Final exam	30	Mid-December	1, 2, 3	**√**
Laboratories	25	Weekly	4, 5	**√**
Quizzes and/or assignments	15	Instructor's discretion	1, 2, 3	
Total value:	100%			
Value of final eval (min 40%):	55			

Please Note:

a) A student may drop the lowest unit test mark, if it is lower than the final exam mark, so that the remaining unit tests are worth 20% of the final grade, and the final exam is worth 40% of the final grade. This is not available for a student assigned a grade of zero on a unit test because of cheating.
b) To pass the laboratory portion of the course, a minimum of 60% of the total laboratory grade must be obtained. Failing this, a laboratory grade of **zero** will be given and a maximum grade of 55% will be allowed for the course.
c) Notwithstanding other class grades, if a student passes the laboratory portion of the course, a grade of 60% or more on the final exam will guarantee a pass in the course.
d) Every effort will be made to ensure **equivalence amongst the various sections** of the course. Laboratory experiments are common to all sections, common policies are used with respect to replacement of term grades with final exam marks, the standard required to pass the course is that of

the common text used, and the final exam is both agreed upon by all members of the course committee and graded from a common marking scheme.

E. COURSE CONTENT:

Topics:	Approximate Weeks	Additional Info:
Unit I: Simple Chemical Reactions in Solution 1.1. Use of the particulate nature of matter and stoichiometry to describe and analyze some simple chemical reactions in aqueous solution **Sections** 1,2, 2.3, 2.6-2.7, 3.1, 3.3-3.4, 4.1-4.4, 11.2, 14.1-14.2 in Chemistry 2e by Flowers *et al.*	1-5	1.1.1. Describe the following fundamental particles: atom, molecule, ion, electron. 1.1.2. Describe the nature of solids, liquids and gases in terms of the motions of the fundamental particles. 1.1.3. Define the terms: element, pure substance, mixture, compound, molecular compound, and ionic compound. 1.1.4. Describe the species present when these compounds dissolve in water. 1.1.5. Write formulas for basic chemical substances – chemical nomenclature. 1.1.6. Count amounts of substance present, using the 'mole' concept. 1.1.7. Define molarity and molality. 1.1.8. Describe how to prepare solutions of specific molarity from pure substances and from other solutions (dilution). 1.1.9. Recognize and classify various irreversible processes, specifically electron transfer and double replacement reactions. 1.1.10. Write balanced chemical equations representing the processes described above: 'net ionic equations'. 1.1.11. Define: limiting and excess reactant, theoretical, actual and percent yield.

Topics:	Approximate Weeks	Additional Info:
		1.1.12. Solve problems involving irreversible processes, using basic principles of stoichiometry and 'IRF' tables. 1.1.13. Understand Brønsted-Lowry definition of acids and bases. 1.1.14. Define pH with respect to strong acids and bases.
1.2. Use of proper terminology to describe the nature of aqueous solutions **Sections** 4.2, 11.2-11.3		1.2.1. Define weak, strong and non-electrolyte – predict their conductivity. 1.2.2. Correlate the definition of an electrolyte to the definition of solubility. 1.2.3. Correlate the definition of electrolyte to the definition of weak and strong acids and bases
1.3. Investigation of Redox systems **Sections** 4.2, 17.2-17.3, 17.7		1.3.1. Identify oxidation and reduction reactions. 1.3.2. Determine the products of electrolysis, and identify the oxidizing agent and the reducing agent. 1.3.3. Examine and distinguish between electrolytic and voltaic cells. 1.3.4. Calculate standard cell potentials.
1.4. Analysis of colligative properties of solutions **Sections** 10.4, 11.4		1.4.1. Compare qualitatively the effects of molecular and ionic solutes on vapour pressure of the solvent, and the freezing and boiling points of the solvent. 1.4.2. Calculate ΔT_b and ΔT_f. 1.4.3. Discuss in detail the measurement and calculation o osmotic pressure.

Topics:	Approximate Weeks	Additional Info:
		1.4.4. Discuss the van't Hoff factor ('*i*'), and link to different types of electrolytes. 1.4.5. Use colligative properties to determine molar masses.
<u>Unit II: Chemical Kinetics</u> 2.1. Definition of rate of reaction and interpretation of the rate law **Sections** 12.1-12.3	6-9	2.1.1. Define rate of reaction in terms of the rate of disappearance of reactants and the appearance of products. 2.1.2. Write the rate law for a given reaction. 2.1.3. Define and interpret 'order' of reaction and 'rate constant' of a reaction.
2.2. Measurement of the rate of reaction, order of reaction and the specific rate constant **Section** 12.4		2.2.1. Optimize the experimental parameters so as to determine a rate law. 2.2.2. Use simple zero-, first- and second- order integrated rate laws to determine the order of reaction and the rate constant. 2.2.3. Use a 'swamping' technique to collect kinetics data for a multi-reactant reaction. 2.2.4. Define and use the concept of 'half-life'.
2.3. Discussion of chemical reactions and the factors that affect the rate at which they occur. **Section** 12.5		2.3.1. Describe a reaction in terms of collisions between reacting particles. 2.3.2. Discuss rate of reaction in terms of rate of collisions, rate of effective collisions, and the energy of activation, as described by collision theory. 2.3.3. Interpret and discuss a simple reaction progress diagram, showing the relative energies of reactants and products, and the energy of activation.

Topics:	Approximate Weeks	Additional Info:
		2.3.4. Discuss the effect on the rate of reaction of concentrations of reactants, energy of activation, temperature and a catalyst. 2.3.5. Use the Arrhenius equation to relate the rate of a reaction to the temperature and the activation energy.
2.4. Investigation of reaction mechanism **Sections** 12.6-12.7		2.4.1. Explain 'reaction mechanism'; Rate laws, elementary steps, reaction intermediates, rate determining steps and overall reaction rate laws.
<u>Unit III: Chemical Equilibrium</u> 3.1. Description of chemical equilibrium in qualitative and quantitative terms **Sections** 13.1-13.4	10-15	3.1.1. Define chemical equilibrium and the equilibrium position. 3.1.2. Distinguish between reversible and essentially irreversible processes. 3.1.3. Define the equilibrium constant, *K*, and the reaction quotient, *Q*. 3.1.4. Quantitatively apply Le Chatelier's principle. 3.1.5. Solve problems involving reversible processes using 'IRE' tables.
3.2. Investigation of acid/ base chemical equilibria **Sections** 14.1-14.7		3.2.1. Distinguish between weak and strong acids in terms of their reactions with water, and relate to conjugate pairs. 3.2.2. Define pH and pOH, and K_w. 3.2.3. Solve problems concerning the pH of aqueous solutions by analyzing the acid/ base equilibria of particles in solution. 3.2.4. Demonstrate an awareness of the approximations used in pH calculations.

Topics:	Approximate Weeks	Additional Info:
		3.2.5. Demonstrate an awareness of the chemical species present in aqueous solution and the factors that control the pH. 3.2.6. Recognize why salts may have a non-neutral pH and explain the pH in terms of the reaction of the ions with water. 3.2.7. Estimate and calculate the pH of salts. 3.2.8. Understand what a buffer is and how it works; calculate the pH of buffers both before and after the addition of acid or base.
3.3. Description and analysis of aqueous acid/ base titration curves to illustrate acid/ base equilibria **Section** 14.7		3.3.1. Describe and compare the titration curves for strong and weak acids vs. base, with emphasis on: – the species affecting the pH throughout the titration. – pH at the equivalence point (calculated and measured). – the determination of pK_a (or pK_b) from a titration curve.
3.4. Applications of equilibrium systems **Section** 15.1		3.4.1. Define precipitation as an equilibrium process. 3.4.2. Demonstrate an awareness of the common ion effect. 3.4.3. Predict how the pH will affect the solubility of various slightly soluble salts.

F. REQUIRED TEXTBOOKS/MATERIALS, COURSE COSTS IN ADDITION TO TEXTS (must follow College guidelines):

Title/Item:	Estimated cost ($):
Flowers *et al.,* Chemistry 2e	Free
Lab coat	25
Safety glasses (Prescription glasses are an acceptable substitute.)	11

G. BIBLIOGRAPHY (if applicable):

Suggested books, articles, videos, websites, podcasts that can supplement the course material:
As set by individual teachers.

H. INSTRUCTIONAL METHODS:

Methods used in teaching the course (e.g., lectures, multi-media, group work, etc.):
The course will be 75 hours, divided into Lecture and Laboratory periods, as follows: **Lectures:** 45 hours Two 1.5-hour sessions per week consisting of the introduction of new material, usually accompanied by the working of sample problems. In addition, preparation for upcoming laboratory sessions will be discussed during lecture time. **Laboratory Sessions:** 30 hours. There will be one 2-hour laboratory session per week. Most of them will involve hands-on chemical experiments. Students need to have and wear a lab coat and adequate eye protection—either prescription glasses or safety glasses. The laboratory sessions will demonstrate the basic techniques of experimental chemistry, demonstrate certain properties of solutions, and illustrate some reactions that occur in solution. The chemistry laboratories are equipped with computers interfaced with various instruments and students will be trained in their use.

I. PROGRAM, DEPARTMENTAL/DISIPLINE, AND COURSE/SECTION POLICIES:

Policy:	**Description:**
Approved department attendance policy	Students are expected to attend all lecture and laboratory sessions. Students are responsible for all assigned work, lecture material and other course related material announced or assigned during class. Attendance for laboratory periods is mandatory. Missing a lab period without a valid reason will result in a grade of zero being assigned to any work assigned during that period.
Policy to ensure that issues relating to late submission, or resubmission, of work to be dealt with in an equitable manner	All assigned work is to be submitted on time. Late submission may be accepted, with or without penalty, at the discretion of individual instructors.
Policy dealing with the expectations of classroom behaviour, including use of cell phones, laptops and other technology	Use of personal electronic devices is permitted in the classroom or laboratory with teacher's permission.

Policy:	Description:
Other expectations (if applicable)	1. If you miss an evaluation session or deadline due to illness or other valid reason, you must notify your instructor as soon as possible. A valid medical note is required to prove absence for a medical reason. If a test is missed for a valid reason, then the final exam mark can be used as a basis for a substitute for the missed test mark. 2. A special note concerning the use of chemicals: this course uses chemicals as part of its normal teaching practices. If a student has experienced allergic reactions in the past due to any particular chemical or chemicals, he or she must inform the instructor. In the event that an allergic reaction is experienced at the college, the student should report to Campus Security immediately (local 6911, or 9-514-457-6911). 3. Students are expected to behave respectfully towards their classmates and teachers. In case of inappropriate behaviour a student will be asked to leave the class or the lab session. If an assessment is planned for this session, a mark of zero will be given in that case.

J. COLLEGE POLICIES:

Topic:	Resource:
Student rights and responsibilities (articles 3.2 and 3.3)	Policy 7: IPESA - Institutional Policy on the Evaluation of Student Achievement (version: June 12, 2019)
Changes to evaluation plan in the course outline (article 5.3)	
Religious holidays (articles 3.2.13 and 4.1)	
Cheating and plagiarism (articles 9.1 and 9.2)	
Cheating and plagiarism academic procedure and other resources	Academic Integrity: Cheating and Plagiarism Procedure (version: October 22, 2021) • **You need to log into Omnivox to access the above document** • **For PowerPoint on cheating and plagiarism** refer to the JAC Portal: My JAC Communities / Academic Council / Curriculum Validation Committee (CVC) / Course Outlines – Reference Documents / Academic Integrity • **For link to interactive tutorial on how to cite sources correctly**: http://citeit.ccdmd.qc.ca
Code of conduct	Policy 13: Policy on Student Conduct and Discipline Procedures (version: September 21, 2021)

K. PROVISO:

Attendance: Due to the ongoing pandemic health issues, attendance policies may need to be adjusted by your teacher. The normal attendance expectations are provided above in section I and your teacher will inform you of any modifications as needed. Please note that attendance

continues to be extremely important for your learning, but your teacher may need to define it in different terms based on the way your course is delivered during the semester.

Please note that course outlines may be modified if health authorities change the access allowed on-site. This includes the possibility of changing between in-person and online formats.