

## GENERAL CHEMISTRY B

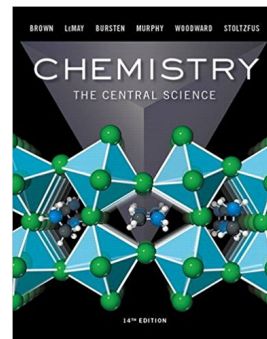
**Instructor:** Willetta Greene-Johnson, Ph. D., Room 307 Cudahy Science 773-508-3537

**Who am I:** A chemical physicist (Stanford University/ University of Chicago) interested in surface optico-physical interactions and mildly interested in (1) thermodynamical (2) unstable systems; (3) producer, composer, orchestrator, pianist, sequencer, and conductor. I guest conducted with the Chicago Sinfonietta two times before and again this past January 2016. One of my songs was doubly tracked on a Grammy award winning CD in 2004. Since then, it has been covered by five other groups.

**Physical Office Hours:** Wednesday 10:00 A – 11:00 A CS-307

**Email Office Hours (ONLY):** Thursday 10:00 A – 11:00 A [wgreene@luc.edu](mailto:wgreene@luc.edu)

- Required: Chemistry, the Central Science.** 14<sup>th</sup> ed. Theodore L. Brown, et. al. Boston: Pearson Prentice Hall: 2011 ISBN: 978-0134414232. (*Mastering Chemistry* is NOT required).
- Chemistry 102 Course Packet**, authored by the instructor. This essential lecture packet is available online at [www.universityreaders.com](http://www.universityreaders.com). The course packet will be mailed to you within a few days of ordering, but you'll have immediate online access to the first 10 or so pages once order is completed.



**Meetings:** Lectures are scheduled MWF in LS-142 at 11:30 P–12:20 P. You must also be registered in discussion sections 002-004.

**Discussions:** meet on Thursdays according to the following schedule:

Section	Instructor	Location	Time
002	Dr. Greene Johnson	IES-007	Th: 10:00 A – 10:50 A
003	Dr. Greene Johnson	FH-105	Th: 11:30 A – 12:20 P
004	Dr. Greene Johnson	FH-105	Th: 2:30 P – 3:20 P



**Due to the large number of students / sections that are matriculated through this course yearly, there can be absolutely no alteration of this schedule.**

**Course Description:** A study of chemical principles and generalizations with emphasis on the development of a scientific attitude and an understanding of the fundamental concepts of chemistry.

**Calculators:** A scientific calculator is sufficient. Calculators cannot be shared while exams are in progress and their cases/covers must be removed. Be familiar with your calculator and the status of its batteries. The student is responsible for having a working calculator in lecture and on an exam day.

**Cell Phone<sup>1</sup> Policy:** It is forbidden to video/audio record lecture (except Loyola University staff). Stills of the board may be taken after class. ***During exams, cell phone, wireless devices, and unauthorized materials are strictly forbidden; subject to device confiscation and dismissal from exam.***

**SAKAI Connection:** The syllabus, homework assignments for the semester, discussions, and discussion answers will be posted at the following website: [www.luc.edu](http://www.luc.edu), look under LINKS, click on **Sakai**). Students possessing a Loyola email address should be able to access this site.

<sup>1</sup> All technology, smart phone, tablets, laptops, Google Glass, whatever... **Violations will be treated as instances of academic dishonesty** (see page 5)

**Additional Information:** For your convenience, test taking tips are listed on page 7 of this syllabus, as well as a protocol on page 8 regarding soliciting a recommendation from me, should you desire one and qualify (see protocol). Academic fall calendar and bookstore information is listed on page 9.

**Objective of this course in grander detail:**

By the conclusion of this course, the student should experience the following outcomes:

- 1. Understand the fundamental principles of physical chemistry**
- 2. Acquire a knowledge base of basic terminology and classifications**
- 3. Apply concepts creatively as well as methodically to solve multi-tiered problems**
- 4. Know how to rank, estimate, analyze and critically evaluate a range of models**
- 5. Gain a broader understanding of the role of chemistry in human endeavor**
- 6. Appreciate the collaborative and global effort of the scientific enterprise**

Specifically the engaged student should improve in her or his ability to





- **Comprehend the following concepts:**
  - Kinetics, reaction rate, Arrhenius equation, rxn mechanism, rate limiting step
  - Dynamic equilibrium and Equilibrium constants
  - Titrations, Buffers, pH, Lewis and Arrhenius A/B models, Solubility product
  - Complex ions and octahedral Crystal Field theory
  - Electrochemical cells (batteries, fuel cells, transduction, respiration)
  - Spontaneity vs. nonspontaneity, entropy, cyclic processes, and free energy
  - Introduction to nuclear chemistry
- **Identify reagents and general chemical processes:**
  - Identify acids, bases, acidic and basic salts, buffers, solubility rules (Chemistry101)
  - write appropriate net ionic prototypical rxns in aqueous solution
  - be able to closely estimate and accurately calculate pH
  - equilibrium constant K and how it predicts spontaneity status of a reaction
  - complex ion, Lewis bases, geometry of “simpler” complex ions and compounds.
- **Assess outcome feasibility:** estimate energy and entropy of chemical processes
- **Work and exchange ideas with others:** cordially solve weekly group problems

- **Appreciate the impact of chemistry:** realize better how chemistry impacts life processes, technology, local, and global issues.
- **Contribute constructively:** as a science-literate, ethically responsible citizen and voter.

Later this semester, you will receive an emailed invitation to assess me via the **IDEA** (Individual Development and Educational Assessment). The form provides a thorough diagnostic of how successfully students think the instructor realized the objectives boxed above, as well as the value of the course and other contextual experiences. This opportunity will be available online at <http://www.luc.edu/IDEA> for a one-week time window only, IDEA manual states: 'As student raters, please be aware that the results of your ratings for this class will be included as part of the information used to make decisions about promotion/tenure/salary increases for this instructor. Fairness to both the individual and the institution require *accurate and honest* answers.'


**Chemistry 102 Schedule of Topics**

Date	Day	Topic	Chapter	Pages (approx)
1/17 JAN	W	Kinetics & Chemical Rate	14	574-582
1/19	F	Integrated Rate Law;	14	582-590, 591- 600, 1 <sup>st</sup> discussion
1/24-1/28	week	Arrhenius Eq'n; k vs. T Rxn mechanisms;	14	601-606 607-615
1/29- 1/31	M, W	Rate limiting step	14	615-622
2/2 FEB	F	Gas phase Equil'm	15	628-637
2/5	M	Const. K; Equil. Table	15	632-644; 644-650
2/7	W	van't Hoff equation	15	648-656
2/9	F	Le Chateliér's Principle	16	657-660
2/12	M	Acid/base categories	16	670-679, 684-687
2/14	W	REV 11,14-16 (~ 25 min)		OPTIONAL
<b>2/16</b>	<b>F</b>	<b>Exam 1: Ch.11, 14-16</b>	<b>IN CLASS</b>	<b>SKIP Every 3<sup>rd</sup> row!</b>
2/19	M	Models, pH, SA, SB	16	664-676; 678-680
2/21	W	A/B Salts, Binary acids	16	694-699, (702-704)
2/23	F	WA,WB strength $K_a$ & $K_b$	16	681-695
2/26	M	Buffers	17	724-729
2/28	W	Titrations SA/SB; SA/WB; SB/WA	17	730-739
3/2 MARCH	F	$K_{sp}$ and ppt equil'm Common Ion Effect	17	740-743 744-746
3/5-10	M-Sa	<b>SPRING BREAK</b>	sPrInG BrEaK	Spr. Break Worksheet
3/12	M	Complex Ions (Lewis Acid/Base)	23 17	1002-1006 756-758
3/14	W	Ligands, Nomenclature	23	1007-1016
3/18	F	Review:16,17,23 ~25 min		Optional no handout
<b>3/19</b>	<b>M</b>	<b>EXAM 2: Ch.16,17, 23</b>	<b>IN CLASS</b>	<b>SKIP Every 3<sup>rd</sup> row!</b>
3/21	W	Crystal Field Theory	23	1020-1026, 1030-3
3/23	F	Spont. And Temp. Statistical origin (physics)	19	812-818 821-828 (opt)
3/26	M	Entropy, standard, 2 <sup>nd</sup> Law	19	818-821,828-831
3/28	W	Gibb's Energy and Temp Gibbs Energy and K	19	831-838 838-841

Date	Day	Topic	Chapter	Pages
<b>MAR. 26(5 PM) LAST DAY TO WITHDRAW WITH A GRADE OF W</b>				
<b>3/29-4/3</b> 	Th-M 	<b>EASTER BREAK</b> 		<b>Disc'n will be held</b>
4/4	W	Coupled Reactions Hess's Law for $\Delta G$ , $\Delta S$	<b>19</b>	842-844
4/6	F	Electrochemistry Redox Review Voltaic Cell $E^{\circ} = E_{\text{ox}}^{\circ} + E_{\text{red}}^{\circ}$	<b>20</b>	856-865 858-868
4/9	M	$E_{\text{red}}^{\circ}$ , $E_{\text{ox}}^{\circ}$ , Spontaneity	<b>20</b>	868-874
4/11	W	Work and $\Delta G$	<b>20</b>	876-879
4/13	F	Graphical Technique	<b>20</b>	In class only
4/16	M	Nernst Equation $E^{\circ}$ and equil'm const. Applications; Electrolysis	<b>20</b>	880-886 886-892 893-896
4/18	W	<b>REVIEW 19-21 (25 min)</b>		Optional may not be a handout
<b>4/20</b>	<b>F</b>	<b>Exam 3: Ch. 19-21</b> (what we get to in Ch. 21)	<b>IN CLASS</b>	<del>Seating-</del> <b>SKIP</b> Every 3 <sup>rd</sup> -row
4/23	M	Solution Equil'm; Units	<b>13</b>	<b>526-538; 539-541</b>
4/25	W	Miscibility; Colligative Properties; Osmosis	<b>13</b>	<b>542-557</b>
4/27	F	REVIEW for Final (minimally 25 min)		lecture may start in 4-26 disc'n
<b>5/4 MAY</b>	<b>M</b>	<b>FINAL EXAM :</b> <b>Ch. 11, 13 - 17,</b> <b>19 - 21, 23</b>	<b>1:00 P - 3:00 P</b>	<b>TBA</b> <b>( LSC-142</b> <b>probably)</b>

## Representative Problems, End of Chapter Problems & Discussions:

Students who are making good progress should be able to solve, independently, most or all of the end-of-chapter problems in the text, listed below as assigned problems, particularly before taking exams. The solution manual is on reserve in Cudahy Library. A comprehensive review containing additional problems will be posted approximately one week before midterm exams; these also serve for final exam.

Discussions count 10% of grade, and should be attended. Worksheet problems will be assigned and solved by groups of 3-4 students within the 50-minute discussion. Students must stay the entire period (unless otherwise instructed) and work on assigned discussion problem(s) to earn up to 10% of grade. The solutions will be posted on SAKAI and graded discussions will be returned by the following discussion, or during the same week if a Friday exam occurs in that week. The student is strongly encouraged to attempt all suggested problems (text-book and discussion) and contribute significantly to the group discussion activity. **Student's extent of group participation will be noted** and mentioned in any recommendation letters.

## Assigned Exercises:

chapter	page	Problems (*means more involved,** means unassigned reading may be required)
11	464	1, 2, 6, 7, 9, 15,17,19, 21, 23, 37, 39, 41, 47, 52, 54, 57, 61, 64, 85: <i>Clausius Clapeyron Eq'n</i> and 2 data points to find $\Delta H_{\text{vap}}$ .
14	610:	3, 5, 7, 9, 12, 14, 19, 21 a - c, 23, 25 (sim. to 23), 27, 29, 33, 35, 37, 39, 41, 43, 46, 50 a-b (glucose is $\text{C}_6\text{H}_{12}\text{O}_6$ ) 57, 61, 63*, 67, 68, 73, 75, 91, 95, 99,105, *117.
21	938	35 – 39a <b>radioactivity</b> (nuclear isotope decay) is a <i>1<sup>st</sup> order kinetic process</i> <i>1 Becquerel (Bq) = s<sup>-1</sup>. 1 gray (Gy) = 1 J per kg of tissue. 1 rad = 10<sup>-2</sup> J/kg of tissue</i>
15	656:	3, 5, 7, 9, 13, 15, 17, 23, 25, 26, 27, 28, 33a, 35, 37 ( $K_P = K_C$ why??), 39, 41, 45 find $[\text{Cl}_2]$ , next $PV = nRT$ , 49, 51, 53, 55, 57, Le Chateliér: 61, 63, 65, 68, *74a,c, 79, 81. <b>I don't overly emphasize <math>K_c</math> vs <math>K_p</math> but for practice, do #24, use formula 15.15 on page 631</b>
16	709:	1, 4, 5, 10, 15, 19, 21, 23, 25, 27, 29, 33, 37, 43, 45, 47, 53, 55, 57, 61, 65a-b, 69, 71, 73, 77, 79, 81, 83, 84, 85, 93, 109, 115, 118*; 95**, 99** **compares various A/B models % ionization = $\cdot 100\%$ ; $x_0$ = starting concentration, unit usually M;
17	766:	1, 5, 6, 17 (% ionization $\leftrightarrow [\text{H}^+]$ ),19, 21, 23, 27, 29, 33, 35, 37, 41, 43, 47,10, 53, 55, 57, 61, 69, 73, 83, 12**, 67 a-b <b>note: <math>K_{sp}</math>, and <math>K_f</math> needed in Prob. 67 concurrently.</b>
19	839:	3, 4, 6, 9ab, 11, 13, 15, 21, 25, 35, 37, 41, 45, 47, 49, 53, 59, 61, 63, 65, 69, 73ab; 79, 83 ( $K_a$ ), 85, 88, 103, 96*: for each species, 1 <sup>st</sup> find $\Delta G^\ominus$ (appendix), 2 <sup>nd</sup> : then use $\Delta G = \Delta G^\ominus + RT\ln Q$ ; note: $\Delta G^\ominus = -RT\ln K_p$ . 75*, 92*, 106**
20	891:	4, 6, 7, 12, 13,15,17 part ii; 19, [23, 25 review balance redox] 29a-e, 31, 37, 39, 43, 53, 55, 57, 59, 61a, 63ab, 65, 67, 76ab, 84b, 88, 99, 102; 106* (organic-y)
23	1023:	15, 16, 23, 25, 27, 33-35, 37, 41, 43, 47, 55, 57, 59, 61, 63; <b>extra nerdy:</b> 73, 74, 78
13	559:	1, 3, 7, 11, 15, 17a, 22, 25, 27, 32, 37-39, 41, 43, 47, 57, 61, 67, 75, 77, 78

### Academic Honesty:

All students are responsible for exercising the highest level of academic honesty while taking exams. They should peruse the College of Arts & Science policy on plagiarism/cheating, stated at:

<https://www.luc.edu/media/lucedu/cas/pdfs/academicintegrity.pdf>

As in the past, cheating will be SEVERELY dealt with, *minimally* costing the offender a grade of “zero” for the item that was submitted; this grade *cannot* be dropped. Additionally, the incident is reported to both the Chemistry Department Chair and the Office of the CAS Dean. Depending on the seriousness of the incident, additional sanctions may be imposed. Which *has* happened before.

### Grading Scheme:

There are two grading schemes, and whichever one yields the higher grade will be employed after the final has been taken:

If all midterms went fairly well: 20 % midterm, 10% discussion, 30% final

If one midterm not so good: 20% the other two, 10% discussion, 50% final

### Grading Scale:

<b>Grade Scale:</b>	<b>A</b>	<b>≥ 91</b>	<b>A-</b>	<b>88-90</b>	
<b>B+</b>	<b>85-87</b>	<b>B</b>	<b>81-84</b>	<b>B-</b>	<b>78-80</b>
<b>C+</b>	<b>75-77</b>	<b>C</b>	<b>71-74</b>	<b>C-</b>	<b>67-70</b>
<b>D+</b>	<b>64-66</b>	<b>D</b>	<b>61-63</b>	<b>F</b>	<b>&lt; 60</b>

### Examinations

Three hour exams and the final exam will be given on **February 16, March 19, April 20, and May 4**, respectively, also noted in the schedule. 90% of your course grade will be determined from these as explained further below. The other 10% will be determined from your discussion grades. The exams are cumulative, *i. e.*, may include material that has been queried on previous exams. The final exam is comprehensive and cumulative.

### Final Exam:

Please note that **the final examination must be taken**. Failure to take the final exam will result in the grade “F”. If a student has missed the final for some valid reason, she/he must present the Dean’s office with reasonable proof of illness or accident, verified by a doctor’s note, police report, *etc.*, in order to

take the makeup final on a single date designated by the Dean's office. A fee may apply and *there is no guarantee that content on the make-up final will correspond to / have the same weight as the scheduled final.*

### Course Repeat Rule:

Effective with the Fall 2017 semester, students are allowed only THREE attempts to pass Chemistry courses with a C- or better grade. The three attempts include withdrawals (W). After the second attempt, the student must secure approval for a third attempt. Students must come to the Chemistry Department, fill out a permission to register form or print it from the Department of Chemistry & Biochemistry: <http://www.luc.edu/chemistry/forms/> and obtain a signature from the Undergraduate Program Director, Assistant Chairperson, or Chairperson in Chemistry. A copy of this form is then taken to your Academic Advisor in Sullivan to secure final permission for the attempt.

### Laboratory:

Chemistry 112, the general chemistry laboratory course, should be taken concurrently with the lecture course in general chemistry. The lecture and the laboratory courses are graded independently. Students should first consult the Chemistry Department Bulletin opposite the wall facing the chemistry office for information. Then, if they still have unresolved issues, they should contact Dr. Angela Boerger, the administrator of the laboratories.

### Student Support Resources:

- ITS HelpDesk
  - [helpdesk@luc.edu](mailto:helpdesk@luc.edu)
  - 773-508-4487
- Library
  - Subject Specialists: <http://libraries.luc.edu/specialists>
- Services for Students with Disabilities
  - <http://www.luc.edu/sswd/>
- Writing Center
  - <http://www.luc.edu/writing/>
- Ethics Hotline
  - <http://luc.edu/sglc/aboutus/>
  - 855.603.6988



## Room Instructions on Exam Days

- 1) When you enter the auditorium, **go to the front** and **place your book bag there**. **Remove your calculator slipcover** and placed it in book bag.
- 2) ~~Starting from the first row nearest the lectern, **sit quickly** in every other seat and **skip every third row**. This vacant third row provides an aisle for the proctor to walk through and address any appropriate questions that student may have during exam. Do not try to sit with friends or near one's usual area. The exam is only **50 minutes**, so excessive delays will cut into exam taking times.~~
- 3) **Place your student ID conspicuously** on your desk so that attendance may be noted (during exam).
- 4) Have **several pencils/pens, eraser**, etc. and a **calculator** in good **working** order.
- 5) Proctors have been instructed to **confiscate the exams of any student** using a calculator with its slipcover in place or **whose actions are suspect**.
- 6) **Read over the entire exam**. You may find a problem in the middle, or at the end, that suits you better to start. The three or so minutes spent glancing over the entire exam will be more than compensated for by the strategy and priorities that you formulate. The recommended **order to do problems** is:
  - (1) what you **know well FIRST**
  - (2) what you're sure you **can at least start NEXT**
  - (3) what you **haven't have a clue LAST**

I have tried to arrange problems in a reasonable order, but my perception and the student's will certainly differ in some aspects. So, take a few minutes to read over the exam and **devise your own strategy**.
- 7) When you have **concluded, turn in your exam** to a proctor. Then **leave as quietly** and as expeditiously as possible as to not disturb other exam takers.
- 8) Normally exams will be returned within two class-meets (with exception of the final exam which usually involves much more calculation).

## Advanced Studies Recommendation Protocol

Later in your student career, you may require a letter of recommendation (LOR) for graduate school, medical school, or the like. If I am chosen among your recommenders, the following policy ensues:

1. **Deadline for LOR (letter of recommendation) requests: Feb 1<sup>st</sup> of the application year.**
2. Student must generally possess GPA of 3.5 or above. However, a student might be considered if she or he presents a **written explanation** that reveals an exceptional circumstance accounting for a lower grade point average.
3. Student must provide attached in one email, a document listing his/her correct GPA, contact information, deadline(s), and also all chemistry, biology and physics courses and labs that the student has taken—in the following format (or Committee format, if you are applying through committee):
  - a. **GPA**
  - b. reliable, current email and telephone # that student checks *regularly*
  - c. **DEADLINE**
  - d. Table with header: course taken, instructor, grade

**Example:**

Course	Semester/year	Instructor	Grade
Chemistry 101	Fall /2017	Dr. WGJ	A-
Biology 210	Spring / 2018	Dr. Barbara Haas	B+

- e. If applying through Committee, *student initiates* process that culminates in a link being sent to me with which to submit LOR.
  - f. If applying “outside the Committee”—see items 5, 6 below, a list of all schools of the applicant and **ALL of their DEADLINES**.
  - g. Regarding part f: all cover forms, application packages, envelopes in one binder, folder, or otherwise secure containment, with like items paper-clipped together.
4. I'd love to read your personal statements, even in rough draft form. It tells me something about you and helps me to shape a recommendation. This article is not required, but I recommend it.
  5. **It is STRONGLY recommended that the student apply through the Loyola Pre-Health Advisory Committee.** Well-regarded by the medical /dental/ pharmaceutical community, the Committee's voice of endorsement will increase the merit of the student's application. Their method also assures that the student's personal statement is strong and well written. If the student applies via Committee, I will be contacted.
  6. **APPLICATIONS OUTSIDE COMMITTEE:** If a student who I can recommend elects to apply apart from the Pre-Health Advisory committee, she/he must perform steps 2-4 and email me at [wgreene@luc.edu](mailto:wgreene@luc.edu). Online LOR uploading protocols (AMCAS, PTCAS, Interfolio, etc.) are **STRONGLY** preferred.

Because of the number of requests, your LOR won't be started until all items in 3 are fulfilled