General Chemistry A (101)

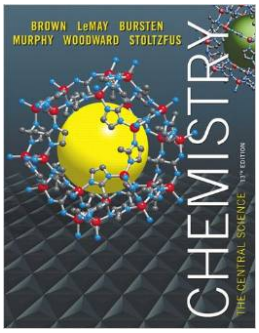
Instructor: Willetta Greene-Johnson, Ph. D., Room 307 Cudahy Science Hall 773-508-3537
wgreene@luc.edu

Who am I: A chemical physicist interested in surface optico-physical interactions and mildly interested in (1) thermodynamics (2) unstable systems; (3) producer, composer, orchestrator, pianist, sequencer, and conductor. I have guest conducted for The Chicago Sinfonietta for several years and recently commissioned by them to score an arrangement for a concert in 2018. My vocal ensemble has recorded two projects. One of my songs was doubly tracked on a Grammy award winning CD in 2004. Since then it has been covered by six other groups, including an ensemble from Milan, Italy.

Physical Office Hours: Wednesday 10:50 AM – 11:30 AM or by appointment

Required:

1. **Required: Chemistry, the Central Science.** 13th ed. Theodore L. Brown, *et. al*. Boston: Pearson Prentice Hall: 2014 ISBN: 978-0321910417. ***Mastering Chemistry* asset is NOT required in my section**
2. Chemistry 101 Course Packet, authored by myself. This essential lecture packet is available online 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 20% or so of it once order is completed.



Meetings: Lectures are scheduled **TWTh** in LSB-212, at 8:00 A –10:40 A.

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: Any scientific calculator is probably sufficient, however calculators cannot be shared while exams are in progress and their cases/covers *must* be removed. Be sure that you are familiar with your calculator and that its batteries are in good condition, especially on the day of exams. The student is responsible for having his calculator on an exam day.

SAKAI Connection: The syllabus, homework assignments for the semester, discussions, and discussion answers will be posted at the following website: **www.luc.edu** *LINKS*, pull-down menu and click on **Sakai**. Students possessing a Loyola email address are able to access this site.

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

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

- **Grasp the fundamentals of chemistry**:
  - Standard calibrations and units of measurement, Stoichiometry, Conservation rules,
  - Ideal Gas Law, 1st Law of thermodynamics, Single component P-T phase diagram
  - Proto-quantum mechanics: Bohr and Einstein relations, Pauli Exclusion Principle, Hund's rule
  - Lewis Diagrams and VSEPR theory (applied to small or otherwise simple molecules)
- **Categorize general chemical processes:**
  - Broadly classify chemical properties (metals / non-metal, acids / bases, *etc.*).
  - Recognize and write reactions, including double exchange, combustion, precipitation, acid-base, and redox and to predict outcomes based upon these reactions
  - Categorize relative bonding strengths between atoms, ions or molecules
  - Predict and be able to sketch geometry of small or otherwise simple molecules
- **Assess outcome feasibility**: estimate energy cost of simpler chemical processes
- **Work and exchange ideas with others**: cordially solve weekly group problems together
- **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.

At the end of term, 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 is usually available online at http//www.luc.edu/IDEA for a one-week time window only, so please watch for it.

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 101 Tentative Schedule of Topics

Week or Day	Topic	Chapter	approx. pages
5/23	Intro Matter, Measurements Significant Figures, Conversions; Periodic Table / Atomic Model	1 1	2 – 16 17 – 32
5/24	Atomic/Formula Masses; Mole (Avogadro's Number); Stoichiometric Calculations	2 3	42 - 68; pg 69 = alkanes 82 - 98; **DISC 1** (9:40-10:40)
5/25 Thursday	**EXAM 1** Limiting Reactant; Theoretical/Actual Yield	1 – 3 3	8:00 A - 9:00 A 98 – 111 9:05 A -10:40 A
5/29	**MEMORIAL DAY**		
5/30	Aqueous Rxns (1) solubility and precipitation (ppt) reaction	4	124 –131
5/31	(2) Acid Base Reactions	4	133 – 143 **DISC 2 for time see above**
6/1 Thursday	**EXAM 2** (3) Redox Reactions, Oxidation Number,	3, 4	8:00 A - 9:00 A 146 – 151 9:05 A -10:40 A
6/6	Half cell method balancing redox in acid solution Stoichiometry in Aqueous Reactions	4	151–156
6/8	Ideal Gas; Calc'n; Molar Mass Density/ Stoich. Dalton's Law /Kinetic Theory / Effusion	10 10	400 – 414 415 – 424 ; **DISC 3**
6/10 Thursday	**EXAM 3** Heat Capacity; Calorimetry	4, 10	8:00 A - 9:00 166 – 185 9:05 A -10:40 A
6/13	Enthalpy; Hess's Law;	5	187 – 201
6/15	Light & Matter; Hydrogen Bohr Model	6	214 – 229 **DISC 4**
6/17 Thursday	**EXAM 4** Pauli's Exclusion Principle PEP	5, 6	8:00 A - 9:00 A 214 – 218 9:05 A -10:40 A
6/20	Electron configuration / Quantum #s n, *l* , m_L s ; Hund's Bus Rule;	6 7	219 – 238 258 – 268 selected reading
6/22	Orb'l Diagrams Paramagnetism, valence configuration; P.T. trends, electronegativity, etc.	8	289 – 306; Ch. 8 298-300, 7 **DISC 5**
6/24 Thursday	**EXAM 5** Covalent Bonding/Lewis structures; Resonance; VSEPR model; σ, π bond	6-8 9 8	8:00 A - 9:00 A 305-312; 314-317;320-332 Formal charge p. 317 also appendix in lecture notes
6/27	Hierarchy of Interstitial Forces; Liquid / Vapor Equilibrium; Phase Diagram	11 11	444 – 452; 457 – 466;
6/29	Molecular Orbital Theory (or selected topic)	9	344–372 Molecular Orbital Theory **DISC 6**
7/01 Thursday	**FINAL** *cumulative*	1 - 11	8:00 A - 10:15 A

HOMEWORK[1]**: is not graded, but student is strongly encouraged to do it, and to do it it well.** A similar assessment is made via weekly discussion assignments. Additionally, **exam representative** problems will be distributed in discussions. **End-of-Chapter Problems:** Students who are making good progress in the course should be able to solve, independently, most or all of the end-of-chapter

[1] The solutions to homework problems will be placed on 2-hour reserve at the Cudahy Library.

problems in the textbook, as well as a number of the problems in discussions. A group of exemplary problems is listed below as "assigned" problems. There are on average 20-25 of these per chapter.

swap underscore for 'orbital box'

CHAPTER	PAGE	PROBLEMS
1	**33**	1, 5, 7, 11, 13, 15, 19, 21, 25, 27(a,c,f), 29, 33, 37, 39, 41, 45. 47, 51, 55, 57 (note: you need to convert ft^3 *to* cm^3, 1 ft ≡ 30.8 cm) 68, 76
2	**73**	1 (physics is everywhere), 3, 5—9, 13, 14, 23, 25, 29, 31, 35, 39, 41, 45, 47, 49, 53 (O = red, C = black, H = white), 55, 59, 63, 67, 69, 71, 75, 79, 81, 99, 103, 105, Ch. 7: 4, p. 290
3	**112**	1, 3, 7, 11, 13, 17, 19, 21, 23 (formula wt ≅ MM), 25, 31, 35, 37, 39, 41, 45, 47, 49, 53, 55, 57, 61, 63, 69, 73, 75, 77, 79, 83, 85, 93, 95
4	**156**	1-3, 5, 7, 13, 17, 23, 25, 27, 29, 31, 33, 35, 39, 43, 45, 47, 51, 53, 59, 63, 65, 69, 73, 75, 77, 83, 87, 89 (for the truly committed.[2] Subtract excess acid mole (from NaOH calc'n) from mol original SA present = am't that reacted with $Mg(OH)_2$, assume 2 OH's released, (true for small conc'ns)) 94
10	**432**	1, 5-7, 9, 10, 17 & 23: $\Delta P = \rho gh$, 27, 33, 35, 39, 41, 43a-b, 49, 51, 55, 57, 59, 63 & 72 (how many moles of each?), 79, 83, 85, 89, 99, 105; *15 (optional P = F/A)
5	**202**	3-5, 7, 9, 10,13,15 (kinetic energy = ½ mv^2 unit Joule (J)), 21, 25, 27, 31, 37, 39, 41, 43, 45, 49, 51, 55, 57, 61, 63, 65, 71, 73, 77, 85, 91, 95,102,106; 89 or 111 (thought expt)
6	**248**	2, 5, 7,11,12,15,19, 21, 25, 27: $\Delta E = \frac{1.196 \cdot 10^5 \frac{kJ \cdot nm}{moL}}{\lambda\ (nm)}$, λ in nm, 29, 37, 41, 43, 45 (similar to 7), 47, 55, 57, 62, 69a, 75-76: textbook's ***condensed electron* config'n** is my **valence e^- confg'n** 78, 79, 86: hc/λ is the energy per photon; energy during CD play = (Power·Δt), 97.
7	**290**	25, 27, 29, 35, 45, 46, 54, 65 **a**(product = strong base) **b**(double exchange rxn) **c**(product = strong acid) , 69,75, 96; *7 (optional)
8	**333**	1, 4, 9, 11, 13, 17, 19, 31-33, 35, 41, 47,48, 51,53, 55, 58, 60, 63; *45: high oxdn # metal polar but **COVALENT** bond; such cations form *either* molecular compound or polyanion
9	**386**	1, 3a-e, 5, 6, 14, 21, 25, 28-30, 33, 35, 37, 39, 41, 47b, 55, 57, 59, 62 (also reply how many σ bonds), 67, 116: C=C π bond energy = 614 kJ/moL. Notes: (1) my parent / orbital geometry ↔ e^- domain geometry), (2) terminology *electron domain* ↔ my *electron pair*. (3) *electron domain geom.* ↔ my *orbital geometry* [3]
11	**471**	1, 2, 6-8,15,17,19, 21, 23, 37, 41, 47, 61, 62a, 64, 84 & 85: *Clausius Clapeyron Eq'n* and 2 data points to find ΔH_{vap}. In problem 85 part c, you don't have to compare.

Examinations and Academic Honesty Five 1 hour-exams and a cumulative final will be given on the dates below, also noted in the schedule.

May 25, June 1, 8, 15, 22, 29

Your course grade will be determined by a protocol elucidated in the Grading Scheme section. ***All exams are cumulative; expect exams after first to include concepts that have been tested on the previous exams***.

Academic Integrity

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:
http://www.luc.edu/cas/pdfs/CAS_Academic_Integrity_Statement_December_07.pdf

Cheating will be SEVERELY dealt with, *minimally* costing the offender a grade of "zero" for the item that was submitted **and this grade cannot be dropped**. Additionally, the incident will be

[2] Interpreted as needed
[3] **orb geom (a) thru' (f): AX_2, AX_3E, AX_4E, ,AX_6. AX_4. AX_2**

reported to 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:

GRADING WEIGHTS

- **Midterms** are each worth **15%**.
- **Discussion Work** is worth **5**%. Discussions are counted out of 10 points
- **Final Exam** is worth **20% or 35%**

Course Grade =

0.05*(Disc. Points) + 0.15 × (Sum of all five Hour Exams) + 0.20 × (FINAL EXAM)

OR

0.05*(Disc. Points) + 0.15 × (Sum of best four Hour Exams) + 0.35 × (FINAL EXAM)

GRADING SCALE

Grading Scale:	**B+** 85-87	**C+** 75-77	**D+** 64-67
A ≥ 91	**B** 81-84	**C** 71-74	**D** 60-63
A- 88-90	**B-** 78-80	**C-** 68-70	**F** < 60

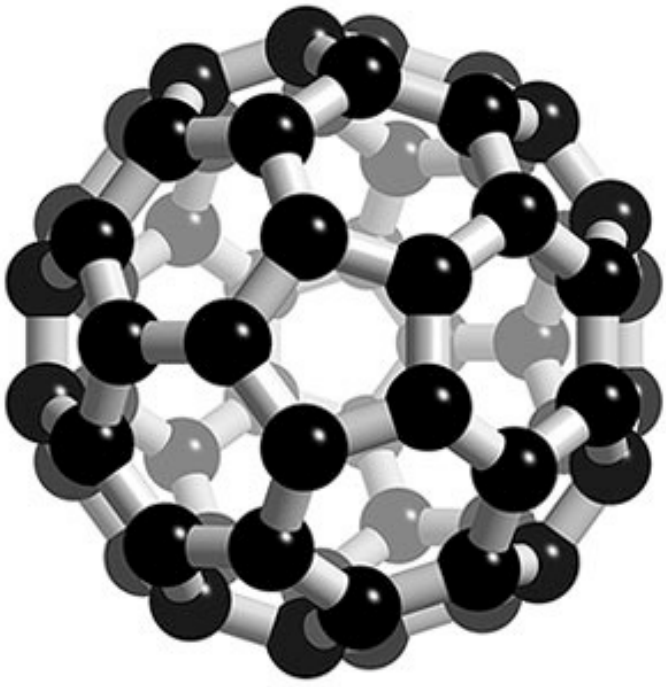
Missed Exams:

The first exam missed for any reason will be dropped. For instance, say that you took exams 1 but had to miss exam 2. Then exam 2 is dropped. If an *additional* exam date is missed for legitimate reason, that *second absence* can be made up within 48 business hours after that scheduled exam. Because of the pace of a summer course, A doctor's note, court summons, police report, or other legal document must accompany the *written* explanation. There can be no exceptions to this policy**:** ***No* make-up exam will be given beyond the Monday after the scheduled Thursday exam.**

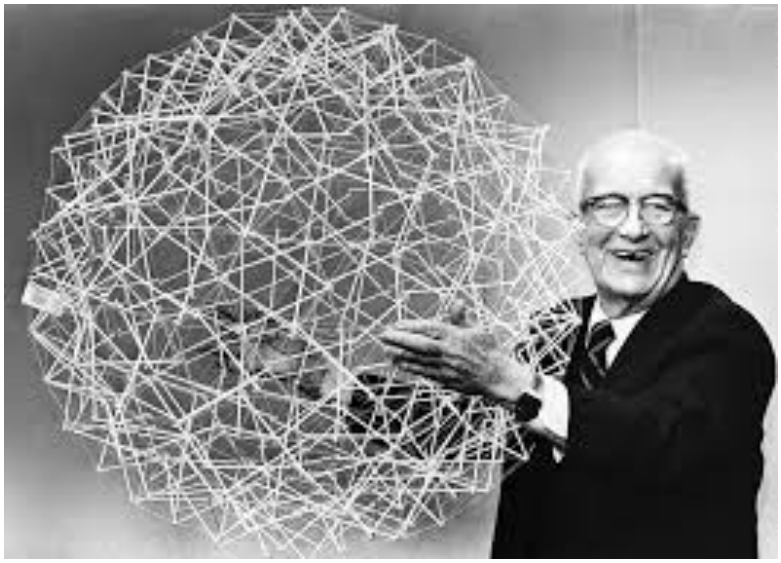
Please make every attempt to take the final exam on time. If the final exam is missed, the student will receive an automatic **WF**. If no action is taken to address the WF, it will automatically revert to an **F**. The student must have valid documentation of why the exam was missed, and must contact the Dean's office of the college in which he/ she is registered. **It is the student's responsibility** to coordinate the make-up exam between the dean's office and the instructor.

Laboratory: CHEM 111, the general chemistry laboratory course is usually taken concurrently with the lecture course. These courses are administered and graded independently. Students should consult the Chemistry Department for information and/or contact **Dr. Angela Boerger**, who directs the laboratories.

Nano-football, anyone?



Buckminster fullerene, C_{60}. is shaped like a soccer ball. It possesses 32 faces, 20 hexagons and 12 pentagons, with carbon atoms at every vertex. This allotrope of carbon was first discovered in 1985 by principle investigators Sir Harold Kroto in the UK and Richard E. Smalley and Robert F. Curl, Jr in the US. These researchers shared the 1996 Nobel prize in chemistry for their discovery. C_{60} and related fullerenes are named for Buckminster Fuller, a renowned 20th century architect, inventor, and futurist.



Room Instructions on Exam Days

1) Find a seat as quickly as you can. Do not try to sit with friends or near one's usual area. The exam is only one hour, so excessive delays will cut into exam-taking times.

2) Place your student ID conspicuously on your desk so that attendance may be noted (during exam).

3) Have several pencils/pens, eraser, etc. and a calculator in good working order.

4) Proctors have been instructed to confiscate the exams of any student using a calculator with its slipcover in place.

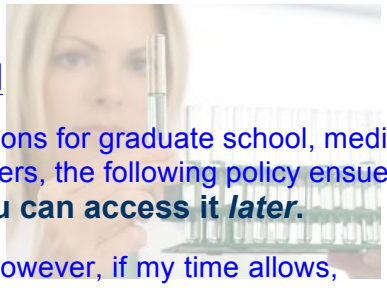
5) **Read over the entire exam**. You may find a problem in the middle, or at the end, that suits you better to start. The three or so minutes spent glancing over the entire exam will be more than compensated for by the strategy and priorities that you formulate. The recommended order to do problems 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 for LAST

   I have tried to arrange problems in a reasonable order, but my perception and that of the student's will certainly differ from time to time. So, take a few minutes to read over the exam and devise your own strategy and order.

6) When you have concluded, turn in your exam to proctor or instructor. Leave as quietly and as expeditiously as possible as to not disturb other exam takers.

7) Normally, exams administered on Thursday will be returned at latest by the following Tuesday. ***Please*** don't harangue the Chemistry staff (and certainly not the physics staff for a chemistry course!) As a general rule, I do not appraise them of my grading schedule. There is normally no issue, however final examination will take the longest to grade (about 6 days) because it is hand-graded. I promise you that I will move as swiftly and as accurately as I can!



Advanced Studies Recommendation Protocol

Later in your student career, you may require recommendations for graduate school, medical school, or the like. If I am chosen among your recommenders, the following policy ensues:

Please save / archive this page NOW so you can access it *later*.

1. Student must generally possess GPA of 3.4 or above. However, if my time allows, 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.

2. Student must provide a Microsoft Word-formatted document listing his/her official transcript GPA, contact information, deadline(s), and also all chemistry, biology and physics courses and labs that the student has take—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 /17	Dr. WGJ	B+
Biology 210	Spring /18	Dr. Barbara Haas	A

   - e. If applying through Committee, you **MUST** include **PDF signed waiver** (2 pgs) in email with other items.
   - f. If applying "outside the Committee"—see items 4,5 below, a list of all schools of the applicant and **ALL of their DEADLINES**.
   - g. All cover forms, application packages, envelopes in one binder, folder, or otherwise secure containment, with like items paper-clipped together.

3. If I can do a recommendation for you, 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.

4. **It is STRONGLY recommended that the student applies 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, s(he) should provide me a cover sheet obtained from the Office of Pre-health (Sullivan Center 262).

5. ***APPLICATIONS OUTSIDE COMMITTEE***: If a student who I can recommend elects to apply outside of committee (apart from the Pre-Health Advisory committee), then she/he must perform steps 1-3 and email me at wgreene@luc.edu (and one other e-address that will be provided). If certain places require accompanying documents that can be distributed via email, the student should provide those documents and email all the attachments, along with doc items request in steps 1 - 3 in one email, to myself.

Deadline for recommendation in 2018 cycle requests: February 1, 2018