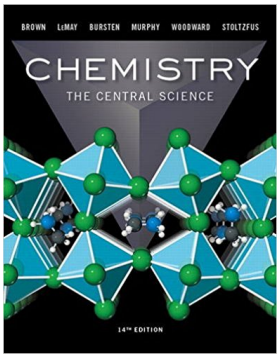
General Chemistry A (101)

Instructor: Willetta Greene Johnson, Ph. D. wgreene@luc.edu
Zoom Office Hours: Wed. 10:15 A –11:30 A, Zoom ID **826-6767-7681** or by appointment.

Who am I: A chemical physicist 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 in 2014, 2016 and premiered a work in 2018 that was revisited by the Cincinnati Symphony Orchestra in March 2019. My vocal ensemble also recorded two compact discs. One of my songs was doubly tracked on a Grammy award winning CD in 2004. Since then, the song has been covered by six other groups, including ensembles from Milan (2017) and Hamburg (2018).



Required: **Chemistry, the Central Science. 14**th ed. Theodore L. Brown, *et. al*. Boston: Pearson Prentice Hall: 2011 ISBN: **978-0134414232**. (*Mastering Chemistry* asset is NOT required in my section, but *may* be required in a future Chemistry 102 section.)

Chemistry 101 Course Packet, authored by the instructor. This essential lecture packet is available online at https://store.cognella.com/60093-5A-001. 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.

Synchronous Meetings:

Monday: May 24 only	8:00 AM - 9:00 AM	Zoom ID **837-8027-2297**
Wed. May 26 until July 2	8:00 AM - 10:00 AM	Zoom ID **826-6767-7681**
Fri. May 28 until July 2	9:15 AM - 10:15 AM	Zoom ID **826-6767-7681**
Fri. **Assessments** 5/28 till 7/2:	8:00 AM - 9:00 AM	***SAKAI TESTS and QUIZZES*** [1]

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

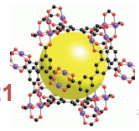
Calculators: A scientific calculator is sufficient. Calculators cannot be shared while exams are in progress and their cases/covers must be removed. Be familiar with your calculator and the status of its batteries. The student is responsible for having a working calculator in lecture and on an exam day.

Mobile and Wireless Devices[2] **Policy:** During exams, cell phone, wireless devices, consultation and unauthorized materials are strictly forbidden; as well as sharing content via these means; discovered violations will result in the minimal penalty of an automatic F on the assessment that cannot be dropped.

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

- **LESSON pages**: Weekly content detail is found on the Lessons pages of our course SAKAI site.
- **TEST AND QUIZZES**: Weekly assessment will be delivered through SAKAI Test and Quizzes. Students will receive an email with a link to take the test.
- **TECHNOLOGY Requirements**: Please see the **Welcome Lesson Page** for details as to what uploads and technology is needed to access the course.

[1] At least 10 minutes will be added to allow student time to render and upload written work if applicable
[2] All technology, smart phone, tablets, laptops, high tech glasses, etc…**Violations will be treated as instances of academic dishonesty** (see page 5)



Statement of Intent: By remaining in this course, students are agreeing to accept this syllabus and to abide by the guidelines outlined in the document. Students will be informed should there be a necessary change to the syllabus.

Intellectual Property: All lectures, notes, and other instructional materials in this course are the intellectual property of the professor. As a result, they may not be distributed or shared in any manner, either on paper or virtually without my written permission. Lectures may not be recorded without my written consent; when consent is given, those recordings may be used for review only and may not be distributed. Recognizing that your work, too, is your intellectual property, I will not share or distribute your work in any form without your written permission.

Class Conduct: One important aspect of a Jesuit education is learning to respect the rights and opinions of others. Please respect others by (1) allowing all classmates the right to voice their opinions without fear of ridicule, and (2) not using profanity or making objectionable (gendered, racial or ethnic) comments, especially comments directed at a classmate.

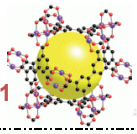
Special Circumstances--Receiving Assistance: Students are urged to contact me should they have questions concerning course materials and procedures. If you have any special circumstance that may have some impact on your course work, please let me know so we can establish a plan for assignment completion. If you require assignment accommodations, please contact me early in the semester so that arrangements can be made with Services for Students with Disabilities (SSWD) (http://www.luc.edu/sswd/).

Student Support Resources:

- ITS HelpDesk
  - helpdesk@luc.edu
  - 773-508-4487
- Library
  - Subject Specialists: http://libraries.luc.edu/specialists
- Services for Students with Disabilities
  - http://www.luc.edu/sac/
- Writing Center
  - http://www.luc.edu/writing/
- Ethics Hotline
  - https://www.luc.edu/hr/ethics/
  - 855.603.6988

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

Objective of course in detail: At the course's end, the student should / should be able to:



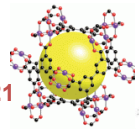
1. Understand the fundamental principles of general chemistry
2. Acquire a knowledge base of basic terminology and classifications
3. Apply concepts creatively as well as methodically to solve multi-tiered problems
4. Rank, estimate, analyze and critically evaluate a range of models
5. Recognize the 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.

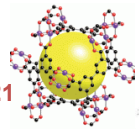
Later in this semester, you will receive an emailed invitation to assess me via the Smart Eval Platform that allows the student to assess how successfully the instructor realized the objectives indicated above, as well as course effectiveness and other contextual experiences. The Smart survey will be sent via a link through Outlook.

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
5/24 – 5/26	Intro Matter, Measurements Significant Figs, Conversions; Periodic Table / Atomic Model	1	2 – 34 Edition 14
5/28 Friday	**EXAM 1** – SAKAI TEST and QUIZZES Discussion Activity units, precision, Law of MP	1 – 2	EXAM = 8:00 A - 9:00 A 9:05 A - 10:05 A
5/31	**MEMORIAL DAY**		
6/1- 6/2	Atomic/Formula Masses; Mole (Avogadro's Number); Stoichiometric Calculations Limiting Reactant; Theoretical/Actual Yield	2 2 3	42 – 45; pg 72 = alkanes 48 – 73; **DISC 2** (8:00 - 10:00) 88 – 110 (post-Assess 1)
6/4 Friday	**EXAM 2** – SAKAI TEST and QUIZZES Disc. & Test content: stoichiometry, empirical formulas	2 – 3 all of both chapters	8:00 A - 9:00 A 9:05 A -10:05 A
6/7 – 6/9	Aqueous Rxns electrolytes/nonelectrolytes (1) solubility and precipitation (ppt) rxn (2) Acid Base Reactions	4	120 –128 129 –136 **DISC 3 for time see above**
6/11 Friday	**EXAM 3** – SAKAI TEST and QUIZZES Identify acids, bases, salts & insoluble ionic compounds, write ppt rxn and A/B reaction	4 ppt, A/B, oxid'n #'s	8:00 A - 9:10 A 9:20 A -10:10 A
6/14 – 6/16	(3) Redox Reactions, Oxidation Number, Half cell method balance in acid solution	4	137 –147 148 –153
	Ideal Gas; Calc'n; Molar Mass Density/ Stoich. Dalton's Law /Kinetic Theory / Effusion	10	394 – 410; 411 – 419 **DISC 4**
6/18	Juneteenth HOLIDAY no Classes		
6/19 or 21	**EXAM 4** – SAKAI TEST and QUIZZES Balance redox rxn, molarity & titration (stoichiometry), ideal gas law, kinetics, Graham's & Dalton's Laws	4, 10 all of both chapters	10:00 A - 11:10 A
6/21-6/23	Heat Capacity; Calorimetry, Enthalpy; Hess's Law;	5	184 – 190 extra: 191-200 164 – 183
	Light & Matter; Planck Relation, Bohr model of H atom; Pauli's Exclusion Principle (PEP)	6	214 – 224
	Uncertainty Principle, Quantum #s n, *l* , m_L ,s ; Electron configuration; Hund's Bus Rule;	6 7	227 – 240
	Valence configuration; Orbital Diagrams; Paramagnetism /Diamagnetism; Periodic Table trends, size, electronegativity, exceptions to PT; Covalent bond, Lewis structures, octet rule	8	241-247, 256-278; 298-308, ionic bonds, Lewis diagrams, octet rule, covalent bonds **DISC 5** 8:00 A - 10:00 A
6/25 Friday	**EXAM 5** – SAKAI TEST and QUIZZES 1st Law, heat, heat capacity, Hess's Law covalent bonds, quantum numbers, periodic table, orbital geom., paramagnetism, Lewis diagrams, octet rule	5 – 8	Ch. 5 thermochemistry: 162-194 8:00 A - 9:10 A textbook ΔE = my ΔU 9:20 A - 10:10 A
6/28 - 6/30	Exceptions to octet rule, multiple bonds and resonance structures; orbital geometry, VSEPR; hybridization, σ, π bonds, polarity, bond strength, bond order, formal charge	9 8	309 – 328; 340 – 368 Formal charge p 318-19
	Molecular Orbital Theory (*optional*) Disc'n: Molecular Geometry & all topics above	9	368–380 Molec. Orb'l Theory **DISC 6** 8:00 A -10:15 A
7/2 Friday	**FINAL** – SAKAI TEST and QUIZZES *cumulative*	1 – 8, 10	8:00 A - 10:00 A



HOMEWORK [3]**: 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 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.

CHAPTER	PAGE	PROBLEMS
1	**35**	1-3, 6, 7, 8, 10, 11, 13, 15, 19, 21, 25 (1 cal = 4.184 J), 31, 32, 35, 39, 42, 43, 45, 47, 49, 51, 54, 55a-c, 57 (for ft^3 *to* cm^3: 1 ft ≡ 30.8 cm) 60, 61, 63, 67, 68 a,c ; **79-82
2	**76**	1 (physics is everywhere), 3, 5—8, 11, 13, 14,19, 23, 25, 27, 29, 31, 35, 39, 41, 45-47, 49, 50, 52, 53 (O = **red**, C = **black**, H = white), 55, 57, 59, 63, 67, 69, 71, 73, 77, 79 (some parts ↔ reactions), 99b, 100,105,109,110 ; Ch. 7: 4, p. 290
3	**112**	1, 3, 7, 9, 11, 13, 15, 19, 21, 23 (formula wt ≅ MM), 25 (a,c,e), 31, 35, 37, 39, 41, 45, 47, 49, 53, 55, 57, 61, 62, 69, 73, 75, 77, 79, 83, 85, 93, 95
4	**155**	1-3, 5*, 7, 15-17, 23, 25, 27, 29, 31, 33, 35, 39, 43, 45, 47, 51, 53, 59, 63, 65 (BAC = Blood Alcohol Count), 69, 73, 75, 77, 83, 87, 89 (for the truly committed.[4] [5]), 94
10	**425**	3, 5-7, 9-11, 27, 28, 33, 37, 39, 41, 43a,b,d; 47-49, 51a, 55, 57, 63, 64, 69, 72 (how many moles of each?), 79, 83, 87, 89 (use 0.285);, *17 & *23: ΔP = ρgh; *15 (P = F/A)
5	**203**	3-5, 7, 9, 11,13,15 (uh,…more physics), 19, 21, 23, 25, 27, 31, 37, 39, 41, 43, 45, 47, 49, 51, 55, 57, 59, 63, 65, 69, 73, 75, 81, 91, 95, 99*, 103**; Ch. 3 (p. 116) 71.
6	**250**	1-5, 7,11,12,15,17,19, 25, 29: $\Delta E = \frac{1.196 \cdot 10^5 \frac{kJ \cdot nm}{moL}}{\lambda\ (nm)}$, λ in nm, 37, 41, 43, 45 (similar to 7), 47, 49, 55, 57, 62, 69, 75-76: textbook's ***condensed electron* config'n** is my **valence e^- confg'n** 78, 79, 86: hc/λ = E photon; energy during CD play = (Power·Δt), 88*, 93, 100**.
7	**290**	2, 7**b**, 25, 27, 29, 35, 45-47, 55, 65 **a**(product = strong base) **b**(double exchange rxn) **c**(product = strong acid). **d**('bicarbonate formed'), 69, 77, 94, 96; 75 **(history),** 54** **(optional)**
8	**330**	1, 4, 9, 11ab, 13, 14, 17, 19, 31-33, 35, 37, 41, 47,48, 51, 53, 55, 58, 59, 63-65; *45: metals found in ionic *AND* covalent comp'ds: some *metal* bonds can be mostly **COVALENT**
9	**386**	1, 3a-e, 4, 5, 7, 9a-c,14-17, 21, 25, 27-30, 33a, dipole: 35, 37, 39, 41, 44; 53, 57, 59, 61, 62 (also find how many π bonds), 67, 86, 87, 102: 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* [6]
~~**21**~~	~~**936**~~	~~1, 5, 9, 11, 13, 15, 17, 21, 29, 31, 47, 49, 55 a, b; 61~~ ~~**optional**: 72, 76*, 80*~~

swap underscore for 'orbital box'

Tutoring. Help is available at the Tutoring Center (Sullivan), ***http://www.luc.edu/tutoring/***[7]

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 28, June 4, 11, 18, 25 July 2

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

[3] The solutions to homework problems will be placed on 2-hour reserve at the Cudahy Library.
[4] Interpreted as needed
[5] Subtract excess mole acid (NaOH calc'n) from mol orig'l SA = am't that reacted w/ $Mg(OH)_2$, assume 2 OH's released, (true for small conc'ns))
[6] **orb geom (a) thru' (f): AX_2, AX_3E, AX_4E, ,AX_6. AX_4. AX_2**
[7] Information from on-campus sources such as The American Chemical Society will be posted on SAKAI once that schedule is made available.

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/media/lucedu/cas/pdfs/academicintegrity.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 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:							
A	≥ 91	**B+**	85-87	**C+**	75-77	**D+**	64-67
A-	88-90	**B**	81-84	**C**	71-74	**D**	60-63
		B-	78-80	**C-**	68-70	**F**	< 60

Important: Due to the nature of chemistry and its logic, exam content is *cumulative*. Subsequent exams will most likely require skills assessed on previous exams and this will definitely be the case for the 'Final Exam'.

Missed Exams:

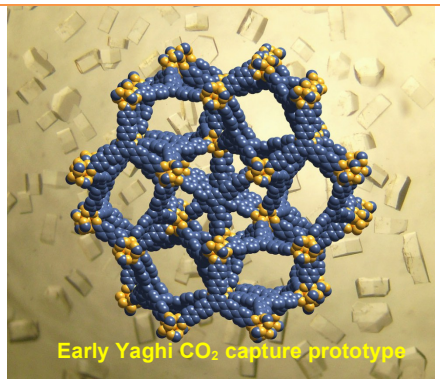
The first exam missed for any reason will be dropped. For instance, say that you took exams 1 but had to miss exam 2. Then exam 2 is dropped. If an *additional* exam date is missed for legitimate reason, that *second absence* can be made up within 48 business hours after that scheduled exam. Because 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**:**

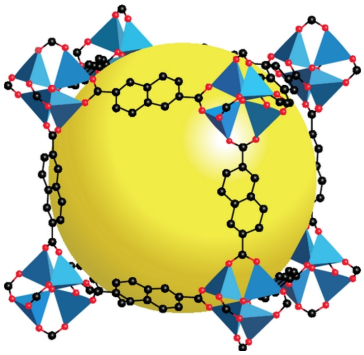
***No* make-up exam will be given beyond the Monday after scheduled Friday exam.**

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.

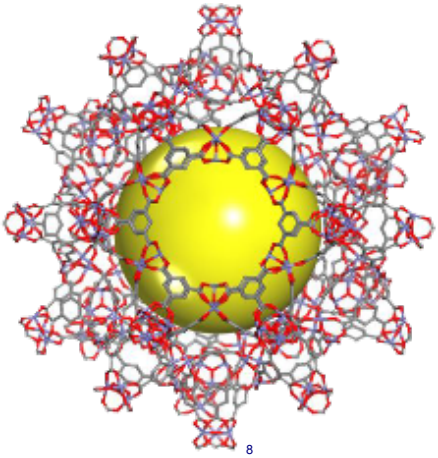
Laboratory: Chemistry 111, general chemistry laboratory course, should be taken concurrently with lecture course in general chemistry. The lecture and laboratory courses are graded independently. Students should first consult the Chemistry Department bulletin opposite the wall facing the chemistry office for information, or contact **Dr. Katrina Binaku (kbinaku@luc.edu),** the laboratory administrator.

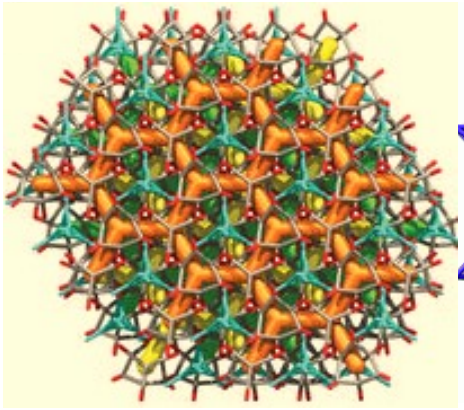
ENERGY CAPACITOR, OXYGEN FILTER,...OR GORGEOUS ART?

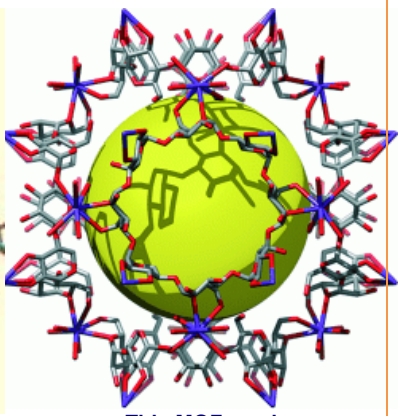



IRMOF-8 ($[Zn_4O(NDC)_3]$)


Zeolite naturally occurs


[8]
O_2 capture prototype


Binary porous co-crystal

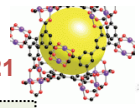

[8]
This MOF can be reconstituted if exposed to H_2O.

Metal organic frameworks (MOF) are compounds with design inspired by naturally occurring zeolite (boiling stones). They are composed of two major components: a metal ion or cluster of metal ions and an organic molecule called a linker. They are often porous and the pores can filter or capture particles. The metal ion and linker choices dictate the size and shape of pores.

These porous crystals are promising for their applications to clean energy storage and generation, clean water generation and delivery, super-capacitors, thermal batteries, ion / electronic conductivity, molecular filters, oxygen or carbon capture, catalysis, and targeted drug delivery. [10]

MOFs have been identified by the US Department of Energy as amongst the most promising next-generation technologies for carbon capture. Some sources project that the global market for carbon capture and sequestration will be worth $221 billion by 2030.

[8] Sandia National Laboratories (2017) so new that what it's made of is proprietary status.
[9] Stoddart http://onlinelibrary.wiley.com/doi/10.1002/anie.201002343/abstract (2010) organic linker = γ-cyclodextrin and metal = alkali salt.
[10] Many groups such as Yaghi (first inventor, UC Berkeley), Stoddart (Northwestern U.), Sholl (Georgia Tech), etc., actively research MOFs.



Recommendations Protocol

Potential Requesters: Please archive this page now so that you can access it later.

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:

1. ***Deadline for LOR (letter of recommendation) requests cycle: February 1 of program application year***. Ex: *If you hope to attend program in Fall 2022, then Feb. 1, 2022*

2. Student must generally possess GPA of 3.5 or above. This is mainly due to volume of requests. However, a student might be considered if she/ he presents a **written explanation** that reveals exceptional circumstances that might account for a lower GPA.

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 taken—in the following format (or Committee format, if 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	Summer /20	Dr. WGJ	B+
Biology 210	Spring / 21	Dr. Barbara Haas	A-

   e. If applying through Committee, be sure to handle the **signed waiver** with Pre-Health. Send the other items to me (wgreene@luc.edu) in one email.

   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. All cover forms, application packages, envelopes should be 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 is not required, but very useful.

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, they should provide me a cover sheet obtained from the Office of Pre-health (Sullivan Center 262).

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 materials to wgreene@luc.edu. Online LOR uploading protocols (AMCAS, PTCAS, Interfolio, *etc.*) are ***STRONGLY*** preferred.

7. Due to volume of requests, your LOR won't be started until all items in step 2 are fulfilled.

Just in case you need a LOR later: copy this information now and save it in a memorable location.