General Chemistry II CHEM102 Fall 2013

Updated 7/30/13

COURSE DESCRIPTION: Fundamental laws of chemical action and the properties, uses and methods of preparation of the more important elements and their compounds. Includes one three hour laboratory per week that introduces basic experiments in general chemistry. Continuation of CHEM101. Includes one three hour lab per week that is a continuation of the laboratory experience begun in CHEM101.

PREREQUISITE: CHEM101

- **Instructor**: Dr. J. A. Wingrave; Office (204BRL); Phone (1676); e-mail (wingrave@udel.edu)
- **Lecture:** Sections: -020L to -021L : MWF, from 11.10 - 11:00 am in **207BRL**
- **Required Course Supplies** (Available at University Bookstore)
  - **Textbook**: Burdge, Chemistry, 2nd Ed., Prentice-Hall (Copy in Chemistry Library, 201BRL) ISBN: 0-07-302554-2 OR 978-0-07-302554-4
  - **Lab Manual**: Laboratory Manual for General Chemistry, 3rd Ed., Kramer, Wingrave ISBN: 978-0-7380-3578-9
  - **Lecture Manual:** Chem102 Lecture Manual, Wingrave, 2013
  - **i>clicker Device** rf response key pad (a.k.a, "clicker") - Purchase at bookstore
  - **Lab Protection**: Safety Goggles are **REQUIRED AT ALL TIMES IN THE LAB!** **Long Pants Shoes & Shirts with Sleeves Required.** **NO Shorts, Skirts, Sandals, Open Toed Shoes or Bare midriffs.**
  - **Calculators** **ONLY Non-Programmable, Non-Graphing Calculators - NO EXCEPTIONS.** Required functions; +, -, x, ÷, log, ln, x^y, trig - Cheap about $15
- **Other Resources**
  - Workshop sessions for problem help.
  - TA and Professor's Office hours
  - Tutors (Private and Group) - For more info, see Mrs. Staib in BRL102 (831-2465)
  - Academic Enrichment Center
  - Student Solutions Manual: Burdge, Chemistry, 2nd Ed. (Copy in Chemistry Library, 201BRL)

OFFICE HOUR - Problem Solving (204BRL/308QDH)

Tuesday,	11:00am - 12:00pm (noon)
Wednesday,	11:00am - 12:00pm (noon)
Monday, Thursday, Friday	NO PROBLEM SOLVING OFFICE HOURS

OFFICE HOUR - General Questions (204BRL)

Thursday,	11:00am - 12:00pm (noon)
Monday-Wednesday, Friday	NO GENERAL QUESTIONS OFFICE HOURS

TA OFFICE HOURS - To Be Announced

• Safety Training for Laboratory

- If you took chem101, you have already had safety training so only a review of lab safety is required. The lab safety review for chem102 will be done during the first week of lab.

• Laboratory

- Lab meets once a week. First Lab meets, Tuesday, Sept. 3(Tue.) OR 5(Thur), 2013.
- Report to lab promptly each week in order to hear lab instruction presentation by TA.
- **Due as you ENTER lab** each week - **2 ITEMS**;
  1) A Written Lab Procedure (An example lab procedure for Lab #1 can be found on the SAKAI course website.)
  2) An MSDS analysis for two chemicals used in that week's lab.
- **Start Of Lab;**
  1) Lab Quiz given by TA (5 Multiple choice questions - Use ONLY Procedure).
  2) **PRE LAB DEMOS (PLD)**; Demos done by TA while students complete PLD.
     - The PLD for each lab can be found in the back of the Lecture Manual
- **Due as you LEAVE lab** each week - **3 ITEMS**;
  1) Pre-Lab Demo,
  2) Lab and,
  3) Post Lab report.
- **Make-up Labs** -
  1) See Professor Wingrave (or Ms. Ayers-Alexander in 104BRL) for a lab pass.
  2) Labs and make-up labs can ONLY be done during the week scheduled **AND** with a lab pass. Plan ahead!!
- **Missed labs** will be either EXCUSED or UNEXCUSED.
  - A score of zero (0) will be recorded for an UNEXCUSED LAB (AND Pre-Lab DEMO).
  - No score will be recorded for an EXCUSED LAB.
  - EXCUSED LAB requires an acceptable note given to TA from RA, parent, doctor, etc.
- **IMPORTANT** - Each Unexcused missed lab will lower your lab score.
  - Each missed lab that is EXCUSED will NOT affect your lab score.
  - An excessive number of missed labs (excused PLUS unexcused) will result in an incomplete grade for chem102F13.
- **Safety Goggles** - Must have either "ANSI" or "AS/NZS" on the lense.
- Lab is inseparable part of chem102F13. Your lab grade is part of your chem102F13 grade.
- **NOTE**: Excessive number of missed labs will result in an incomplete grade for chem102F13.

• Quizzes – In Lecture

- There will be clicker quizzes given randomly in lecture.
- A working **i>clicker device IS REQUIRED FOR CREDIT.**
- Quizzes will be a problem working session - Bring pencil, paper and calculator.
- All quizzes will be summed together for a total of 56 points over the course of the semester.
- If half or more of the quiz questions are answered correctly, a quiz grade of 56 will be earned.
- **No make-up Quizzes and no credit earned if absent or if i>clicker device malfunctions.**
- Answer ONLY with your own 'clicker'. Do NOT answer with more than one 'clicker'.
- Answering with more than one 'clicker' constitutes a breach of academic ethics and will result in a zero Quiz Score.

• SAKAI Web Resources

- CHEM103F13 WINGRAVE - Course website, clicker grades sheets
- CHEM103F13 LAB - Lab website, all Lab scores
- CHEM103F13 WORKSHOP - Workshop website - all Workshop scores

• Workshops, Wednesday 3:35-5:00 pm

- Workshops will be held each Wednesday, beginning with Workshop 0 on August 28 in 207BRL
- **ALTERNATE-TIME WORKSHOPS** – Scheduled ONLY during Workshop 0.
- A total of fifty six (56) points TOTAL for the whole semester are possible.
- No Workshop sessions will be held on weeks when exams are given.
- Workshop problems will be presented in a **Jeopardy Game** format.
- Workshop problems are taken from old final exams given by Prof. Wingrave.
- **WORKSHOP GRADE** – Based on group work. No credit for working by yourself.
- **MISSED WORKSHOPS** – NO Makeup Workshops
  - If you miss a Workshop - Attend an alternate time Workshop.
  - Be sure to tell Workshop Leader if you visit an alternate time Workshop.
  - If group work is satisfactory, Workshop Leader will give you credit for the Workshop you missed.
- DATES: See Schedule below; ROOMS: _____ (020L) : _____ (021L)

• Exams

- Three (3) in-class exams will be given. No make-up exams will be given.
- Missed exams will either be:
  - UNEXCUSED – An exam score of zero (0) will be recorded.
  - EXCUSED – Final exam score will replace an excused/missed exam(s). An EXCUSED EXAM requires an acceptable note given to Professor from parent or doctor.
- Lowest exam score will be replaced by final exam score. An EXCUSED exam score will be considered a "lowest exam score".
- Exams Cover: textbook, Workshop, laboratory, i>Clicker and Lecture Manual material.

* Exam corrections must be made PRIOR to the next exam date.

- The Final Exam will be cumulative over all course material. The Final Exam is mandatory.
- Needed - ONLY a pen/pencil and non-graphing calculator at your desk for an exam.
- Everything except a pen/pencil and a non-graphing calculator must go to the front of the exam room prior to the start of the exam.
- "Everything" includes but is not limited to: book bags, clothing, cell phones & other electronic devices, books, notebooks, scratch paper, calculator lids, etc.
- Possessing items during an exam OTHER THAN a pen/pencil and a non-graphing calculator constitutes a breach of academic ethics and will result in a zero score for the exam in question.

• Exam Regrading

- Exams for regrading must be received by the professor before the subsequent exam.
- An exam regrade will constitute a complete regrade of the ENTIRE exam by the professor.

• Final Exam

- The FINAL EXAM will be cumulative over all course material. The Final Exam is mandatory.
- The Final exam will be given on the date scheduled by the University. **NO EARLY OR LATE FINAL EXAM** will be given for any reason.
- **MAKEUP FINAL EXAM DATE(S)** will be scheduled after the end of the semester and announced during the semester. Contact Professor Wingrave.
- An Excessive Number of **MISSED LABS** or a **MISSED FINAL EXAM** will result in a grade of "INCOMPLETE" for chem102F13.
- An "INCOMPLETE" grade in chem102F13 converts to a grade of "F" on February 18, 2013.
- Makeup Final Exams given by Reservation ONLY on Saturday, February 2, 2013.
  Contact Prof. Wingrave to schedule a Make-Up Final Exam..

• Minimum requirements for obtaining a passing grade in CHEM-102 are:

- Successful completion of all thirteen (13) laboratory experiments.
- Successful completion of the final examination.
- Obtaining a total of at least 400 points on the "Grading Schedule" outlined below.
- MISSED FINAL EXAM or Excessive Number of MISSED LABS will result in a grade of "INCOMPLETE" for chem102F13.
- An "INCOMPLETE" grade in chem102F13 converts to a grade of "F" on February 24, 2014.

• Tentative Grading Scheme

- **Three Examinations (3 x 120 points, 45 %)**
- **Laboratory Grade (208 points, 26 %)**
- **Final Examination (120 points, 15 %)**
- **Workshops (56 points, 7 %)**
- **Quizzes in Lecture (56 points, 7 %)**
- **<u>Midterm Grade</u> Will Be Based On Exam #1 – ONLY – No Lab Grade !**
- **If You Have No Exam #1 Score, Your <u>Midterm Grade</u> Will Be an "N".**

TTL POINTS (%)	GRADE	TTL POINTS (%)	GRADE	TTL POINTS (%)	GRADE
800-720 (90)	A	625-600 (75)	B -	475-450 (56)	D +
720-700 (88)	A -	600-575 (72)	C +	450-425 (53)	D
700-675 (84)	B +	575-500 (63)	C	425-400 (50)	D -
675-625 (78)	B	500-475 (59)	C -	400-0	F

• Language Dictionary Use During Exams

The University's policy is that a language barrier does not constitute a "special needs/learning disability" case, so students in this situation are not referred to the DSS Office. The chem103 policy for language dictionary use on exams will be to approve INSPECTED PAPER language dictionaries but ELECTRONIC language dictionaries will NOT be allowed at any time.

• Grade Change DEADLINE - Final Exam

Each student should routinely check their Sakai site for chem103 throughout the semester for their scores on the following; 1) Workshop, 2) Lab, 3) i>clicker (quizzes) and 4) exams. Grading errors must be corrected prior to the final exam. After the final exam all grades will be final and will NOT be changed. Grading errors can be corrected by contacting the following instructors prior to the final exam. Exception* - Deadline for changes to the final exam are 2-10-14 to 2/21/14.

Workshop score	Workshop Leader
Lab score	Lab Teaching Assistant (TA)
i>clicker score	Professor
exam score	Professor
* Final exam score	Professor (Time for changes, 2/10/13 to 2/21/13)

General Chemistry II | CHEM102 | Fall 2013

Sections 20L, 21L (TR)

Updated 7/30/13

Chap	Lecture & Topics
1-12	0. Syllabus and Introduction **{1. REVIEW: VSEPR Theory, Inorganic Nomenclature}** **{2. Concentration Units }**
13	3. Henry's Law and Colligative Properties
25	4. Organic I - Aliphatic, Aromatic, Isomer Nomenclature
25	5. Organic II – Functional Group Nomenclature & Prop.
14	6. Kinetics I - Kinetic Rate Law & Catalysis 7. Kinetics II – Integral Rate Law & Half Life
14 21	8. Kinetics III - Collision Theory & Arrhenius Equations **{9. Nuclear Chemistry}**
15	10. Keq I - Kinetic / Equilibrium Equations, LeChatelier's Principles 11. Keq II - Quantitative Chemical Equilibrium Calculation
16 17	12. A/B I – pH, pOH, pKa, pKb, pKw 13. A/B II – Titration Plots for Strong Acids & Bases
17	13. A/B II – Titration Plots for Strong Acids & Bases 14. A/B III – Weak Acids & Bases
17	15. A/B IV,V - Titration Plots for Weak A/B, Buffers **{16. A/B VI – Buffers & Equivalence Point }**
17	17. Ksp Chemistry
19	18. Electrochemistry I - Half Reactions & Redox Equations 19. Electrochemistry II – Voltaic Cells & Nernst Equation
19	19. Electrochemistry II – Voltaic Cells & Nernst Equation 20. Electrochemistry III – Voltaic & Electrolytic Cells
25	21. Polymers: Addition, Condensation & Natural Polymers
12	22. Solution Properties & Colloids
- -	23. Environmental Chemistry
- -	24. Thermodynamics I: 1st Law, Enthalpy, Entropy & Spontaneity
- -	25. Thermodynamics II: Hess' Law, Standard Formation
- -	26. Thermodynamics III: Thermodynamic Prop Calculations

{Lectures on Course Capture on SAKAI}

• Lab, EXAM and Workshop Schedule

Updated 8/1/13

Lab Dates	Week	Chem102 - Experiment Subject	Workshop/Exam
8/26 M	1	**Summer Vacation**	
8/27 T & 8/30 F	1	**NO LAB**	**Workshop 0 8/28**
9/2 M	2	**Labor Day**	
9/3 T & 9/5 R	2	1) Lab#23 - Anion Qualitative Analysis	**Workshop 1 9/4**
9/10 T & 9/12 R	3	2) Lab#28 - Cation Analysis	**Workshop 2 9/11**
9/17 T & 9/19 R	4	3) Lab#33 -Determination of Solution Concentration	**Workshop 3 9/18**
9/24 T & 9/26 R	5	4) Lab #14 - Colligative Properties w/Computer Analysis	**Exam #1 9/25**
10/1 T & 10/3 R	6	5) Lab #22 - Ester Synthesis	**Workshop 4 10/2**
10/8 T & 10/10 R	7 (§)	6) Lab #31 - Radioactivity (§13) Lab #12 Using Lewis Structures	**Workshop 5 10/9**
10/15 T & 10/17 R	8	7) Lab #21 - Chemical Kinetics	**Workshop 6 10/16**
10/22 T & 10/24 R	9	8) Lab #17 - LeChatelier's Principle	**Exam #2 10/23**
10/29 T & 10/31 R	10	9) Lab #16 - Determination of Equilibrium Constant	**Workshop 7 10/30**
11/5 T	10	*** **ELECTION DAY** ***	- - - - -
11/5 T & 11/7 R	11	10) Lab#20 - pH & Applications	**Workshop 8 11/6**
11/12 T & 11/14 R	12	11) Lab #18 - Solubility Constant Determination	**Workshop 9 11/13**
11/19 T & 11/21 R	13	12) Lab #26 - Voltaic Cells	**Exam #3 11/20**
11/25 M - 11/26	14	**NO LAB**	**NO Workshop**
11/27 W – 12/1 Su	14	* **THANKSGIVING** *	**NO Workshop**
12/2 M – 12/4 W	15		**NO Workshop**
12/5 R	15	**READING DAY**	**NO Workshop**
12/6 F - 12/13 F	16	**FINAL EXAMS**	**NO Workshop**

(§13) Lab # 12 Using Lewis Structures, Due in Lab this Week (Due in Lab October 8,10)

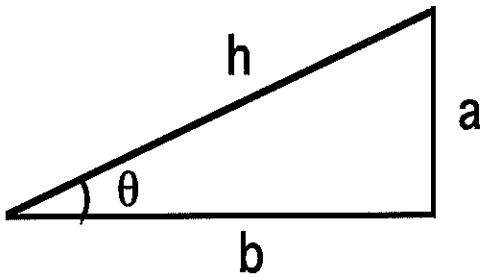
BASIC MATH FUNCTIONS

A. Exponents

1. $x^2 \bullet x^3 = x^{2+3} = x^5$
2. $x^5 \bullet y^5 = (xy)^5$
3. $x^3 \bullet y^4 = x^3 y^4 = y\left(x^3 y^3\right) = y(x\,y)^3$
4. $\left(x^2\right)^5 = x^{(2\bullet 5)} = x^{10}$
5. $\sqrt[3]{x^6} = \left(x^6\right)^{1/3} = x^{(6/3)} = x^2$
6. $\sqrt{x^6} = \left(x^6\right)^{1/2} = x^{(6/2)} = x^3$
7. $x^{-4} = \dfrac{1}{x^4}$
8. $\dfrac{x^5}{x^3} = x^{5-3} = x^2$

B. Logs

1. $\log 1000 = +3.0$ ⋮ $10^{+3} = 10^{\log 1000} = 1000$
2. $\ln 1000 = +6.91$ ⋮ $e^{+6.91} = e^{\ln 1000} = 1000$
3. $pH \equiv -\log\left[H^+\right]$ ⋮ $\left[H^+\right] = 10^{-pH}$
4. $\log x^7 = 7 \bullet \log x$
5. $\ln x^6 = 6 \bullet \ln x$
6. $\ln x = 2.303 \log x$
7. $\log xy = \log x + \log y$
8. $\log \dfrac{y}{x} = \log y - \log x$
9. $\log (x+y) = \log (x+y)$



C. Trig:

1. $h^2 = a^2 + b^2$: $a = \sqrt{h^2 - b^2}$ b

2. $\sin\theta = \dfrac{\text{opposite}}{\text{hypotenuse}} = \dfrac{a}{h} = \dfrac{1}{\sec\theta}$

3. $\cos\theta = \dfrac{\text{adjacent}}{\text{hypotenuse}} = \dfrac{b}{h} = \dfrac{1}{\csc\theta}$

4. $\tan\theta = \dfrac{\text{opposite}}{\text{adjacent}} = \dfrac{a}{b} = \dfrac{1}{\cot\theta} = \dfrac{\sin\theta}{\cos\theta} = \left(\dfrac{a}{h}\right)\left(\dfrac{h}{b}\right) = \dfrac{a}{b}$

5. $1 = \sin^2\theta + \cos^2\theta$

D. Mensuration:

1. $C = \pi d = 2\pi r$ ⋮ Circumference of circle
2. $A = \pi r^2 = \dfrac{\pi}{4} d^2$ ⋮ Area of circle
3. $A = 2\pi r L$ ⋮ Area of cylinder
4. $A = 4\pi r^2$ ⋮ Area of sphere
5. $A = \dfrac{1}{2} bh$ ⋮ Area of RIGHT triangle
6. $A = 6L^2$ ⋮ Area of cube
7. $V = L^3$ ⋮ Volume of cube
8. $V = \dfrac{4}{3}\pi r^3$ ⋮ Volume of sphere
9. $V = \pi r^2 L$ ⋮ Volume of cylinder

E. Quadratic Equation

: $ax^2 + bx + c = 0$ ⋮ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

• Learning Goals for Chemistry 102

(Numbers in parentheses indicate the departmental learning goals (http://www.udel.edu/chem/goals.html) with which each course goal is aligned.)

1. Describe the characteristic features of covalent bonding and explain/apply their relationship to physical properties; write/analyze Lewis structures and explain/predict molecular geometries and polarities for covalent compounds; explain/apply valence bond and molecular orbital theory in evaluating bonding in covalent molecules and extended solids. (1)
2. Assign/interpret names and formulas for ionic/binary compounds, know charges of common mono- and polyatomic ions, and use in balanced equations. (1)
3. Describe key intermolecular forces and apply this knowledge in connecting molecular structures and physical properties of condensed states. (1)
4. Interpret/construct simple phase diagrams; quantitative calculations of heating curves and using the Clausius-Clapeyron equation. (1)
5. Describe the characteristic features of ionic bonding and explain/apply their connection to the physical and chemical properties of ionic compounds. (1)
6. Describe empirical gas laws; explain/apply kinetic theory in the analysis/prediction of the behavior of ideal and real gases; examine reaction mechanisms based molecular structure and collision theory. (1, 5)
7. Discuss the enthalpic, entropic, and external factors involved in solution formation; apply this knowledge in explaining/predicting the behavior of solutions; explain the effects solutes have on solvent properties; explain/predict the quantitative conductivity behavior of electrolytes in solution; explain/calculate colligative properties. (1, 5)
8. Recognize common organic functional groups, and name/interpret names for simple organic molecules; rationalize/predict products for simple nucleophilic and electrophilic reactions involving alcohols, carbonyl derivatives and alkenes(1)
9. Interpret/propose experiments and analyze kinetic data to determine reaction orders, rate laws, activation energies and mechanisms; explain/interpret/predict reaction mechanisms based on kinetic data, molecular structure and collision theory. (1, 5)
10. Identify species as acids or bases according to various classification systems, and predict/interpret their chemical behavior according to these models (including gas phase, aqueous and non-aqueous solvent conditions); predict/rationalize pK_a, pK_b values for compounds based on molecular structure and inductive, resonant and steric effects. (1)
11. Understand the concept of hydrolysis; use hydrolysis to understanding the behavior of salts in aqueous solutions; explore the application of hydrolysis to understand acid/base buffer behavior; calculate pH for salt hydrolysis and buffer behavior in aqueous solutions. (1)
12. Understand the application of mass action chemistry for quantitative calculation of solubilities of salts in aqueous solutions; explore the use of K_{sp} for chemical separation, common ion effects and the effect of pH on salt solubility. (1)
13. Describe different types of nuclear decay processes and calculate associated changes in energy, predict nuclear stability based on nuclear shell model and N/Z ratios, recognize/explain processes of nuclear fusion and fission and their applications, and describe the effects of radiation on matter and common uses of radioactive materials. (1)
14. Explain the distinguishing features of voltaic and electrolytic cells, calculate cell potentials, and use/interpret reduction potential data to explain/predict chemical behavior; discuss key features of different types of batteries and electrolytic processes. (1)
15. The ability to use instrumentation for chemical analysis and characterization. (6)
16. Evaluation/description of MSDS for chemical safety and hygiene. (7)
17. Calculate/interpret statistical data analysis of experimental data. Perform/explain/calculate standard deviation and confidence intervals for replicate experimental data. (2,4)
18. Perform/explain statistical data rejection; discuss scientific ethics of data rejection. (9)
19. Work together with other students discussing ideas, evaluating information and formulating solutions to problems. (8)
20. Communicate ideas clearly and effectively in written and oral formats. (10)
21. Find and evaluate sources and information needed in solving problems. (3)