Brooklyn College
Department of Chemistry
General Chemistry II Syllabus

GENERAL CHEMISTRY II – SPRING 2010

If you took Chemistry 1.1 and 1.2, you should realize that these courses go at half the rate of Chemistry 2, so ***in Chem 2 you will have to work twice as hard as you did in Chem 1.1 and 1.2.***

Required Texts:
- *Chemistry, The Central Science*, Brown, LeMay and Bursten, Prentice Hall Pub., 2009, 11th Edition.
- *Laboratory Manual for General Chemistry*, M. N. Kobrak, Ed., First Edition," Kendall/Hunt, Dubuque, IA 2008.
- *Electrochemical Cells and Reduction Potentials*, Lab Separate ELEC-418 Chemical Education Resources.

Required Items:
- Scientific calculator, • lock for lab drawer,
- Safety goggles; matches; dish detergent, roll of paper towels.
- Small bound notebook for lab.

Graphing calculators are not allowed on exams.

Recommended Items:
- Lab coat or apron.
- Study Guide to Brown, LeMay and Bursten, James C. Hill, 11th Ed., Prentice Hall.
- Solutions to Exercises in Brown, LeMay and Bursten, R. Wilson, 11th Ed., Prentice Hall.
- Schaum's Outline: Beginning Chemistry, D. E. Goldberg, 2nd Edition, McGraw Hill Pub., N.Y., 1999.

Online Supplements and Info:

http://academic.brooklyn.cuny.edu/chem/GenChem/chem2syl.pdf (syllabus on line)
http://academic.brooklyn.cuny.edu/chem/howell/practice.htm (old BC tests and exams)
http://academic.brooklyn.cuny.edu/chem/index.htm (Chemistry Department Homepage)

Counseling

Coordinator for General Chemistry	TBA
Undergraduate Chemistry Advisor:	TBA
Undergraduate Deputy Chair:	Prof. Jarzecki, 359NE jarzecki@brooklyn.cuny.edu
Health Profession Counseling:	Prof. Silbering 3207B silbering@brooklyn.cuny.edu

Lecture Tests:

- FIRST TEST: Thursday, **March 11, 2010, 12:30 – 2:00 PM**, Covers Recitations 1–5
- SECOND TEST: Thursday, **April 22, 2010, 12:30 – 2:00 PM**, Covers Recitations 6–10

(for recitation material see page 5)

NOTE: **NO** Makeup exams are given for Lecture Tests. We mean it.
Graphing calculators are not allowed on exams.

FINAL EXAM: **MAY 20, 2010 (Th), 8:00 AM – 10:00 AM**, rooms TBA

Academic dishonesty is prohibited in the City University of New York.

Cheating, plagiarism, internet plagiarism and obtaining unfair advantages are violations of policies of academic integrity and are punishable by penalties, failing grades, suspension and expulsion. For more information about CUNY policy on academic integrity see **http://www.brooklyn.cuny.edu/bc/policies/pdf/CUNY%20PolicyAcademicIntegrity.pdf**

Lab Exemptions: Students who are repeating the course may be able to obtain laboratory exemptions. You may file a request for a laboratory exemption form in the Chemistry Department office (359 NE). Students who receive exemptions **must take the recitation quizzes** and possibly the lab quizzes.

Drop Dates: **February 17** (Wednesday) is the last day to drop a course without a grade. **April 20** (Tuesday) is the last day to apply for non penalty withdrawal (*i.e.*, W grade). See your lab instructor or the course coordinator for advice. **To withdraw, you MUST file a form in the Registrar's Office (either electronically or in person) and go to the stockroom to CHECK OUT from the laboratory.**

Grading:

Your final grade will be determined as follows:

30%	Two lecture tests
20%	Minimum of five recitation quizzes
18%	Laboratory reports and performance
7%	Two laboratory quizzes
25%	Final exam

Chemistry 2 Lecture Schedule

Unless specific sections are indicated, you are responsible for the whole chapter.

For best results read the assigned material before lecture.

Lecture #	Topics	Assigned Reading
1, 2	Chemical Kinetics	Chapter 14 (omit Arrhenius Equation p. 596-599; section 14.5 will be covered at the discretion of the instructor; additional problems on this material may be assigned)
3, 4	Chemical Equilibrium	Chapter 15
5, 6	Acids and Bases	Chapter 16 (omit Section 16.10). Appendix A.2-logarithms
7, 8	Aqueous Equilibria, Acid-Base	Chapter 17, Sections 17.1–17.3
9 – 11	Aqueous Equilibria, Precipitation	Chapter 17, Sections 17.4–17.7
12, 13	Entropy and Free Energy	Chapter 19
14	Oxidation-Reduction	Chapter 4, p.137–144 Chapter 20, Sections 20.1, 20.2
15, 16, 17	Electrochemistry Equivalents and Normality	Chapter 20, Sections 20.3–20.7, 20.9 See: last page of the syllabus
18	Metallic Bonding, Transition Metals	Chapter 23, Sections 23.5 and 23.7
19, 20	Coordination Compounds	Chapter 24
21, 22	Hybrid Orbitals, Periodic Trends	Chapter 9, Sections 9.4–9.6 Chapter 22, Section 22.1
23, 24	Organic Chemistry	Chapter 12, Section 12.6 Chapter 25, Sections 25.1–25.6
25	Biochemistry	Chapter 25, Sections 25.7–25.11
26, 27	Nuclear Chemistry	Chapter 21
28	REVIEW	

NOTE: YOUR EXPERIENCE IN CHEM 1 SHOULD HAVE TAUGHT YOU THAT HARD WORK AND LOTS OF STUDY ARE NECESSARY FOR SUCCESS.
TO PASS CHEM 2 WITH A GOOD GRADE, YOU MUST STUDY AT LEAST 10 HOURS EACH WEEK. PLAN YOUR SCHEDULE ACCORDINGLY!

Reading and Homework Assignments for Weekly Recitation Meetings

Meeting #	Assigned Material
Meeting 1 Read: Homework:	**Chemical Kinetics** Chapter 14 (omit Arrhenius Equation p. 596-599), Sections: 14.1–14.3 Chapter 14, Problems 15,17,19,21,26,27,30,33,37,40,
Meeting 2 Read: Homework:	**Chemical Equilibrium** Chapter 14, Sections: 14.4–14.7 (omit Arrhenius Equation p. 596-599), and Chapter 15, Sections: 15.1–15.4 Chapter 14, Problems 47,53,54,55,61,62,64,67,68,69,71,73,75,99 Chapter 15, Problems 6,13,15,19,21
Meeting 3 Read: Homework:	**Acids and Bases** Chapter 15, Sections: 15.5–15.7, and Chapter 16, Sections 16.1–16.4, Appendix A.2 Chapter 15, Problems 27,30,31, 33,35,37,43,44,49,51,53,70 Chapter 16, Problems 15,16,17,18,19,21,23,28,29,30,31,32,36,39,
Meeting 4 Read: Homework:	**Acid-Base Chemistry** Chapter 16, Sections 16.5–16.9, 16.11, Appendix A.2 Chapter 16; Probl. 43,47,51,55,59,73,75,79,83,85,101,124 Work through Sample Exercise 16.13 (p. 687) and do the associated Practice Exercise (p. 688)
Meeting 5 Read: Homework:	**Acid-Base Chemistry, Aqueous Equilibria** Chapter 17, Section 17.1–17.3 Chapter 17, Problems 15,17,19,23,25,33,34,39,41,43,
Meeting 6 Read: Homework:	**Aqueous Equilibria and Precipitation** Chapter 17, Sections 17.4–17.7 Chapter 17, Problems 47,49,53,56,58,60,61,63,65,67
Meeting 7 Read: Homework:	**Entropy and Free Energy** Chapter 19 Chapter 19, Probl. 9,10,33,39,40,41,49,51,53,55,61,63,65,67,73,75,78,81,94,107
Meeting 8 Read: Homework:	**Oxidation-Reduction, Electrochemistry** Chapter 4, p.137–144 and Chapter 20, Sections 20.1–20.5 Chapter 4, Problems 49,50,51 and Chapter 20, Problems 11,12,15,19,21,23,24,25,35,37,40,43,44,47,57
Meeting 9 Read: Homework:	**Electrochemistry** Chapter 20, Sections 20.6, 20.7, 20.9 Chapter 20, Problems 54,55,59,60,61,72,87,88,93,94
Meeting 10 Read: Homework:	**Transition Metals, Coordination Compounds** Chapter 23, Sections 23.5, 23.7 and Chapter 24 Chapter 23, Problems 41,43,45,46 and Chapter 24, Problems 11,13,23,27,29,28, 31,32,36,39,41,43,45

Meeting 11	**Hybrid Orbitals**
Read:	Chapter 9, Sections 9.4, 9.5
Homework:	Chapter 9, Problems 40,43,46,47
Meeting 12	**Hybrid Orbitals, Periodic Trends**
Read:	Chapter 9, Section 9.6 and Chapter 22, Section 22.1
Homework:	Chapter 9, Problems 49,50,51,55,57 and Chapter 22, Problems 11,12,13,15
Meeting 13	**Organic Chemistry, Biochemistry**
Read:	Chapter 25 and Chapter 12, Section 12.6
Homework:	Chapter 25, Problems 13,14,18,19,20,21,31, 39,40,41,55,57,67,75 and Chapter 12, Problems 39,40,41,44,75
Meeting 14	**Nuclear Chemistry**
Read:	Chapter 21
Homework:	Chapter 21,Probl.7,9,11,17,19, 21,24,28,30,33,36,39,47,56,58,59

NOTE: Your instructor has the option of scheduling a two-hour recitation session for the 14th meeting.

Chemistry 2 Laboratory

Before coming to laboratory, read the scheduled experiment and any other material assigned. Unless otherwise noted, page numbers refer to your laboratory manual. You must bring the lab manual to each lab class.

Brooklyn College recognizes the importance of reproductive hazard awareness and protection. During laboratory exercises students may be exposed to chemical reagents that may present specific risks to reproductive health, especially students who are pregnant. Therefore, it is strongly recommended that you do not take the following course if you are pregnant. If you become pregnant during the semester, please consult with your laboratory instructor.

NOTE: **SAFETY GOGGLES MUST BE WORN IN THE LABORATORY!** The goggles must be indirectly-vented to offer splash protection; direct vented goggles (sold by hardware stores for impact protection) are not suitable. The campus bookstore sells appropriate goggles. **If your instructor observes you violating eye protection or other safety policies, you can be removed from the laboratory and/or given a 10% (or higher) penalty on your laboratory report grade.**

Scientific data requires special treatment. It must be recorded in non-erasable ink your lab book immediately after a measurement is taken; partners cannot copy each others' data at a later time. **Altering or copying data outside of the laboratory represents academic dishonesty and will be prosecuted as such if observed.** Further, you will receive no credit for any lab report that includes data that are not your own. If your data are messy, you may copy them over onto a final report, but you must include your original data when you turn in your report.

Lab reports are due in lab the week after the experiment was concluded unless you obtain permission from your instructor. All lab reports not handed in will receive a grade of zero.

If your lab instructor is **not** grading the lab reports and returning them to you, please **notify the lecturer.**

From meeting four (Expt. 3) on, you are required to hand in an outline described at the end of the lab schedule.

Schedule of Lab Experiments in Chemistry 2

Meeting	Laboratory Assignment
1	Check in and Experiment 20; Qualitative Analysis Group I: known and unknown. Read: Techniques of Qualitative Analysis in the lab manual.
2	Experiment 27; Rates of Reaction
3	Experiment 23; Qualitative Analysis - Anions
4	Experiment 31; Colorimetric Equilibrium Study
5	Experiment 15; pH and Buffers
6	Experiment 21; Groups II-V Cation known. Read Introduction to Qualitative Analysis
7	Conclude Expt. 21
8	Experiment 22; Cation Unknown
9	Conclude Expt. 22
10	Experiment 24; Unknown Salt (Review Expt. 23)
11	Experiment 11 or 12; Oxidation - Reduction Note: Expt. 11 in Spring semester, Expt. 12 in Fall semester.
12	Conclude Expt. 11 or l2
13	Electrochemistry Experiment
14	Check out. NO WORK PERMITTED

EQUIVALENTS AND NORMALITY

(1) Acid-Base Reactions. One **equivalent** of an acid (or base) is an amount that supplies one mole of H^+ or OH^- ions. For example, one equivalent of HCl is the same as one mole of HCl, but one equivalent of H_2SO_4 is 0.5 moles of H_2SO_4. This is because each mole of H_2SO_4 supplies two moles of H^+ ions, and we only need 1/2 a mole of H_2SO_4 to get one mole of H^+.

The **equivalent weight** is the mass of one equivalent. For example, the equivalent weight of H_2SO_4 is one-half of its molar mass, namely 49 g/equiv.

The **normality** of a solution is the number of equivalents of the solute in the solution divided by the solution's volume in liters. As an example, consider a 3.0 M H_2SO_4(aq) solution. This solution has 3 moles of H_2SO_4 per liter, and since each mole of H_2SO_4 is 2 equivalents of H_2SO_4, there are 6 equivalents of H_2SO_4 per liter and the solution's normality is 6.0 N, where N stands for equivalents per liter.

Since one mole of H^+ ions reacts with one mole of OH^- ions, ***one equivalent of acid always reacts with one equivalent of base*** in a titration (even though one mole of acid may not always react with one mole of base).

Problem: What is the molarity of a 0.04 N $Ba(OH)_2(aq)$ solution?

(2) Oxidation–Reduction Reactions. One **equivalent** of an oxidizing or reducing agent is an amount that gains or loses one mole of electrons. For example, in the reaction $2\ Al + 3\ Zn^{2+} \rightarrow 2\ Al^{3+} + 3\ Zn$, one mole of Zn^{2+} gains two moles of electrons when it is reduced to Zn according to $Zn^{2+} + 2e^- \rightarrow Zn$, so one mole of Zn^{2+} is two equivalents and one equivalent of Zn^{2+} is 0.5 moles of Zn^{2+}.

The **equivalent weight** is the mass of one equivalent. For example, the equivalent weight of Al in the preceding reaction is one-third of its molar mass.

The **normality** of a solution is the number of equivalents of solute per liter of solution. In the preceding reaction, a 3.0 M $ZnSO_4$ solution is 6.0 N, since one mole of zinc ion is two equivalents.

Since the number of moles of electrons gained and lost are equal in a balanced redox reaction, ***one equivalent of oxidizing agent always reacts with one equivalent of reducing agent.***

Problem: (a) Find the normality of a 4.0 M $KMnO_4(aq)$ solution for a reaction in which one product is $Mn^{2+}(aq)$. (b) Find the normality of a 4.0 M $KMnO_4(aq)$ solution for a reaction in which one product is $MnO_2(s)$. Answers: (a) 20.0 N; (b) 12.0 N.