Chemistry 100: Chemistry Appreciation (Lecture only - 3 s.h.)

The purpose of this introductory chemistry course is to provide students with the knowledge to understand our world/universe from the viewpoint of fundamental chemical principles and to introduce them to many of the tools used in scientific inquiry which have enabled us to enhance our understanding of the natural world. The studies of chemistry involve the study of matter and the transformations it undergoes. The applications of these studies will provide students with an enhanced understanding of many phenomena which affect our daily lives, such as the synthesis, purification and mode of action of many common chemicals, including gasoline, antacids and polymers.

Catalog Description:

Selected chemistry concepts presented as lecture-demonstrations for students who wish to gain an appreciation of the chemical world. Meets the Natural Science requirement under the Arts & Sciences Core of the University Studies program. Not intended as preparation for other chemistry courses. Does not preclude taking any other chemistry courses for credit. No laboratory. No prerequisite. Not open to students with credit in higher numbered chemistry courses. Offered each semester.

This course includes requirements and learning activities that promote students' abilities to...

a. understand how scientists approach and solve problems in the natural sciences;

Requirements: Students are taught the scientific method. Many different real world problems are presented and students are expected to learn how to apply the scientific method and the principles of chemistry to solving and understanding chemical phenomena.

Activities: Students are provided with many opportunities to apply chemistry concepts. Activities include classroom demonstrations, in-class problem solving sessions, and instructor-led and group discussion. One example involves the use of a conductivity apparatus to determine whether various materials and solutions will conduct electricity. By testing a number of different materials, the students as a group identify the characteristics of those materials which will “light up” the bulb. They then use that information to predict whether untested materials should also conduct electricity.

b. apply those methods to solve problems that arise in the natural sciences;

Requirements: Students are expected to apply the methods and the techniques of problem solving in many varieties of science and chemistry phenomena.

Activities: Students apply various techniques such as pattern recognition and trend analysis to solve many problems. Two demonstrations of periodic trends are commonly performed. One demonstration involves the reaction of water with several metals from the same group on the period table. A second involves the reaction of halogens with halide salts. The students correctly note that there are trends within each group and are able to predict which untested elements will give the strongest reactions.
c. use inductive reasoning, mathematics, or statistics to solve problems in natural science;
Requirements: Solving problems in chemistry related phenomena invariably involve the use of inductive reasoning and mathematics (and/or statistics). Students are presented with many problems and laboratory exercises that require these skills in solving the problems.
Activities: Activities such as homework assignments, in-class exercises, and demonstration reports require inductive reasoning and mathematical skills. One example of a common problem which occurs in science is the separation of a mixture. The students work in small groups to separate a number of plastic pieces into various categories and then identify the steps used in that separation, which involves using differences in various physical characteristics. These general principles are then applied to a mixture of three solids and students devise a separation scheme which will allow them to separate the mixture into the three pure substances. Their scheme is then tested in class.

d. engage in independent and collaborative learning;
Requirements: The class as a whole performs and observes the demonstration and gathers a single data set. Small group discussions are encouraged in the initial stages of analyzing what has been observed. The entire class then discusses the demonstration and the explanation in a collaborative manner. However, students are required to submit some assignments and written work independently.
Activities: Some demonstration-lecture period activities include having students work in small groups to develop an explanation for the phenomenon which they have just observed before the entire class discusses the phenomenon. Other lecture activities include group discussions on conceptual applications to real world problems in natural science.

e. identify, find, and use the tools of information science as it relates to natural science;
Requirements: Students are required to employ many tools of information science, such as searching scientific/chemistry journals/references in both non-electronic and electronic formats, to gather information which will allow them to understand issues and to propose solutions to problems in natural science.
Activities: There are “special topic” writing assignments required each semester. Students are either assigned a specific topic or choose a topic from among several possibilities. They then consult appropriate sources for relevant information on chemical and physical properties as well as on economic and societal effects. They are required to use both print and electronic sources for their papers. Usage of such tools of information science enhances the students’ ability in investigative techniques in different areas of natural science. In recent years the general topics have included the composition of a commercial product, the effect of a particular area of chemistry on the economy and on society, whether nuclear power plants should be used to generate electricity, the effects of using DDT in specific situations, and the biography of an element of the student’s choice.

f. critically evaluate both source and content of scientific information; and
Requirements: Classroom demonstrations and lecture assignments are designed for critical evaluation by students. Chemical concepts are tested against the experimental phenomena demonstrated in the lecture-demonstration periods.
Activities: Students are assessed based on their performance on quizzes, tests, demonstration and activity reports and special topic writing assignments. These activities are designed to
allow students the opportunity to critically evaluate both the source and the content of chemical information.

g. recognize and correct scientific misconceptions.
Requirements: Many chemical concepts (such as the three-dimensional shapes of molecules) are difficult and abstract. Students are taught to recognize misconceptions in chemical concepts and how to revise and correct with proper perspectives.
Activities: Students often think of molecules as flat entities which have all of the atoms arranged in a straight line or in a plane and they find it very difficult to picture molecules as three-dimensional structures. In the classroom students work with molecular model kits and build actual three-dimensional models of molecules, which clearly show the actual arrangement of atoms in the molecules. This exercise is one example of providing students with opportunities to critically evaluate and demystify chemical misconceptions in atomic and molecular structures.
Sample Syllabus (will vary from instructor to instructor)

Winona State University
Chemistry 100 - Chemistry Appreciation
Fall Semester, 2008

Instructor: R. A. Reuter
Office: PA 330 (Office hours posted)
Phone: 457-5874
E-mail: rreuter@winona.edu
Web: http://course1.winona.edu/rreuter
https://winona.ims.mnscu.edu (D2L site)

Catalog Description: Selected chemistry concepts presented as lecture-demonstrations for students who wish to gain an appreciation of the chemical world. Meets the Natural Science requirement of the Arts and Sciences Core of the University Studies program. Not intended as preparation for other chemistry courses. Does not preclude taking any other chemistry courses for credit. No laboratory. No prerequisite. Not open to students with credit in higher numbered chemistry courses. Offered each semester.

Lecture: Sect 01 T, R 2:00 - 3:20 p.m. PA 329


Other:
1. Demonstration Sheets for Chemistry 100 (available from web site)
2. Periodic Table
3. A three-ring binder or other suitable folder for completed demonstration report or activity sheets and other course materials

TENTATIVE COURSE OUTLINE

Chapter(s) Major Topics Include:

1, 2, PPTs Scientific method, history of chemistry, branches of chemistry, risks and benefits of chemistry, measurements and observations, states of matter, mixtures, pure substances, chemical separations

3 Elements and atoms, atomic structure, periodic trends

4, 5 Molecules and compounds, bonding, ions in solution

5 Chemical reactions

7 Light and color
8 Nuclear chemistry
9, 10 Energy and society, sources and uses of energy (selected topics)
6, 15 Organic compounds and polymers
13 Acids and bases
14 Oxidation and reduction, electricity (selected topics)
11, 12 Air and water (selected topics)
15-18 Chemistry in everyday life (selected topics)
All Current selected issues in chemistry

Course Details and Requirements:

Student Numbers: Each student will be assigned a student number to facilitate collection and return of student work. Please write your name and student number on both the front and back of all papers.

General: Students are expected to read assignments prior to class, attend and participate in the lecture-demonstration periods, complete the demonstration report sheets, read the assigned chapters, complete, submit and present all assignments, and pass the quizzes, tests and final exam. Successful completion of studies of the lecture topics outlined above will satisfy the Natural Sciences requirement for the Arts and Sciences Core of the University Studies program. Specific outcomes for each class component are identified below. A full list of outcomes for University Studies Natural Science courses is also given below.

Classes: There will be two lecture-demonstration periods during the week. The demonstrations and explanations of chemical phenomena presented during class and text assignments provide the body of the course. Theories will be introduced as needed to help explain the phenomena. Therefore it is expected that the student will attend every class period. [Outcomes a, b, c, d, f and g]

Assignments: Written or oral assignments on special topics [Outcomes d, e, and f] and small group, homework and reading assignments [Outcomes a, b, c, f and g] will be given during the course of the semester. Supplementary handouts and reading materials may also be distributed during the semester.

Notebook: A three-ring binder or other suitable folder should be used to contain all demonstration report sheets, whether graded or not, tests, quizzes, assignments, class and reading notes,
homework, and other course materials. These may be collected and graded for completeness by the instructor at least once during the semester.

**Demonstration and Activity Report Sheets:**
Demonstration report sheets may be downloaded from the course web site. Activity sheets will either be available on the web or distributed in class. (It is recommended that you always have several blank sheets available in your notebook.) Each student will complete a demonstration/activity sheet for each demonstration or in-class special group activity [Outcomes a, b, c, d, e, f, and g]. However, not all of the demonstration/activity sheets will be collected and graded. At the end of each lecture period the instructor will determine whether the sheets for that day will be collected and graded. Each day’s sheet(s) will earn a maximum of 20 points, no matter how many demonstrations were performed on that day. The lowest demonstration/activity sheet score will be dropped. Demonstration and activity sheets will be graded according to the following criteria:

a. Are all sections filled out?
b. In the “brief description of the demonstration”, have the main points been noted? If the answers were not given in class, are the student’s answers correct?
c. Have questions been noted, and if answers were given in class, have they been noted? If the answers were not given in class, are the student’s answers correct?
d. Has the student stated what he or she learned in the demonstration or activity?
e. Is the student’s understanding of basic chemical ideas increasing as the course progress?
f. Does the student correctly use terms and symbols that have been defined or introduced?
g. Do the student’s questions indicate a serious inquisitiveness or are they routine?
h. Does the student use diagrams in the description where appropriate?
i. Does the student use complete sentences and express herself or himself clearly?
j. Has the student made a thorough review of the topic and provided a detailed description?

**Homework:** Specific homework assignments may be given during the semester. Homework assignments will be not be collected and graded, but the answers will be posted. It is suggested that you work the end-of-chapter problems, especially assigned problems, as they will help to prepare you for quizzes and tests. [Outcomes a, b, c, d]

**Quizzes:** There will be several quizzes during the semester. Quizzes may be announced or unannounced. Some quizzes may be web quizzes. In-class quizzes will generally be approximately 5-10 minutes in length and may be given either at the beginning or at the end of the lecture period. There will be NO make-up quizzes during the semester. Make-up quizzes for those students who demonstrate to the satisfaction of the instructor a legitimate reason for having missed a quiz will be given at the end of the semester. The lowest quiz score will be dropped. [Outcomes a, b, c, d, f and g] (See attendance policy below.)

**Tests:** There will be two tests during the semester plus a comprehensive final exam. Tentative test dates are Thursday, September 25 and Thursday, October 30. Exact test dates and the material covered will be announced at least one week in advance. [Outcomes a, b, c, d, f and g] (See attendance policy below.)
Final Exam: The final exam for the course will be comprehensive. However, more emphasis will be placed on material covered after the second test. The time for the final exam is:

Sect 01 Tuesday December 9, 2008 1:00 - 3:00 p.m.

Help: Should you have questions about the material or experience any difficulty in the course, please see me as soon as possible so that we can clear up your questions or deal with problems.

Attendance: It is expected that the student will attend every class and attendance will be taken. If you are absent, you will still be responsible for the material covered in class even if you registered late or were “excused”.

A written statement or a health service card should be submitted to the instructor as soon as possible after the illness. The statement should give your name, the date and time of the class you missed and which test or “demonstration” day you missed. Except for an illness documented by the Health Service or other medical practitioner, it will be necessary to give a specific reason for your absence.

The lowest demonstration/activity score AND the lowest quiz score will be dropped. Students able to document to the satisfaction of the instructor a legitimate reason for having missed more than one quiz or demonstration score will be given an opportunity to make up the missing points. Students who need to make up a demonstration will be given an alternative assignment which can be substituted for the missing demonstration report. It is recommended that such assignments be completed as soon as possible. See the instructor for the assignment.

If you must be absent during a test period, you MUST notify the instructor as soon as possible. Students able to document to the satisfaction of the instructor a legitimate reason for having missed a test will either be allowed make up the exam prior to the next class period or will have the weighted average of the other test and the final exam inserted as the grade for the missed test. The specific option used in any situation will be at the discretion of the instructor.

Academic Integrity Policy:
Winona State University has detailed various aspects of its academic integrity policy in the university catalog (p. 28 in 2006-2008 catalog, p. 29 in 2008-2010 catalog). It includes the following description of plagiarism: “Using the words or ideas of another writer without proper acknowledgement so that they may seem as if they are your own. Plagiarism includes behavior such as copying someone else’s work word for word, rewriting someone else’s work with only minor word changes, and/or summarizing someone else’s work without acknowledging the source.” Please note that you must acknowledge other people’s work.
Inclusive Excellence Statement:
WSU recognizes that our individual differences can deepen our understanding of one another and the world around us rather than divide us. In this class, people of all backgrounds are strongly encouraged to share their rich array of perspectives and experiences. If you require specific accommodations or if you have other concerns, please speak with the instructor early in the semester. Many campus resources are available to support you.

Marking Distribution:

Demonstration Sheets/Activities/Special Topics  45% total
Tentative distribution
---Each paper or special topic – 5 to 15% ea
---Each demonstration/activity assignment—
% for each will depend on number collected
Tests 25% (12.5% each)
Quizzes 10%
Final Exam 20% (Date given above.)

Course Grades: Final grades for the course will be assigned according to the following scale:

A  90 %
B  80%
C  67%
D  55%
F  < 55%

University Studies Natural Science Outcomes

Completion of this course will include requirements and learning activities that promote your ability to achieve the following Outcomes:

a. to understand how scientists approach and solve problems in the natural sciences;
b. to apply those methods to solve problems that arise in the natural sciences;
c. to use inductive reasoning, mathematics, or statistics to solve problems in natural science;
d. to engage in independent and collaborative learning;
e. to identify, find, and use the tools of information science as it relates to natural science;
f. to critically evaluate both source and content of scientific information; and
g. to recognize and correct scientific misconceptions.
Additional Documentation:
Examples of Special Topics Writing Assignments (attached)
Faculty web page:   http://course1.winona.edu/rreuter/Chem_100_F08/100_homepage.htm

Special Topics Assignment I: Composition of a Commercial Product

During the course of the semester you will be required to submit two short papers on special topics in chemistry. The intent of these papers is to allow you to explore areas of chemistry which are of special interest to you and to gain a greater appreciation of how chemistry affects us in our daily lives.

The first special topic assignment will focus on the chemical composition of common commercially available products, which are widely used in our society. There are a large number of products from which you may choose. However, a few of the types of products which you might want to consider are those used for personal care, for maintenance of a home or auto, or in a hobby or for your job.

You should choose a product which contains several chemicals. In this assignment you will look at the role which each chemical plays in contributing to the overall effectiveness and function of the product. Your paper will be divided into several parts.

Part 1 will include the name of the product, the purpose for which it is used, and a listing of the various components in the mixture. (5 points)

Part 2 will focus on three of the chemicals which are contained in your product. For each chemical, give: (5 points each)

a. the name of the compound.
b. the chemical formula or structure of the compound.
c. the function of the chemical in your commercial product.
d. any other pertinent information about the chemical, such as where it is found, how it is produced and purified, its properties, disposal problems, etc.

Your paper should be typed and double-spaced. (However, the chemical structure may be hand-drawn.)
All papers must contain a bibliography of appropriate references. You should include at least one reference for each of the three chemicals.

Among the sources which you might consult either for ideas or for background information are books in the chemistry section of the library, scientific journals (Chemical and Engineering News, Science, Nature, Science News, etc, which have short articles of general interest as well as more technical information), popular weekly periodicals, web search engines and internet sites. The Merck Index and Hawley’s Condensed Chemical Dictionary have proved especially helpful to students working on similar assignments in the past. References for internet sites should also contain a web address for a link which connects to the site which you actually cite.
Special Topics Assignment II: Importance of Chemistry to the Economy

During the course of the semester you will be required to submit two short papers on special topics of your choice. The intent of these papers is to allow you to explore areas of chemistry which are of special interest to you and to gain a greater appreciation of how chemistry affects our lives.

The second special topic assignment will focus on the importance of the chemical industry to business and the economy. There are a large number of topics from which you may choose. However, you may wish to consider a single chemical, a specific area of the chemical industry, or some other area of the economy which uses chemicals.

In your paper, please consider the following:

1. the name of the chemical, specialty area or economic area which you are exploring.
2. how the chemical (or group of chemicals) is used.
3. why it is important to the economy (other economic areas which are affected).
4. a discussion of the economic impact of your selected chemical. (This might include such things as annual sales, percentage of overall chemical sales, percentage of GNP, etc.)
5. any social, political, or environmental situation or problem which is either caused or alleviated by this chemical (or group of chemicals) and its effect on the economy.

Your paper should be typed and at least 2 pages in length (double-spaced). All papers must contain a bibliography of appropriate references. You must have at least three sources, one of which is not a web-based source.

Among the sources which you might consult either for ideas or for background information are books in the chemistry section of the library, scientific journals (Chemical and Engineering News, Science, Nature, Science News, etc, which have short articles of general interest as well as more technical information), popular weekly periodicals, web search engines and internet sites. References for internet sites should also contain a web address for a link which connects to your actual reference site.
Special Topics Assignment III: Nuclear Power Plants

Date Due: December 2, 2008, Tuesday

This paper will allow you to explore the intersection of science and society, specifically the issue of nuclear power plants. You will first examine the scientific evidence. You will then examine the question of whether nuclear power plants should be used to generate electricity.

In your paper, please include such things as the following:

a. Give a brief history of nuclear power plants. When were they first used? Where? Where are they used today?
b. How do nuclear power plants work?
c. Give at least three arguments in favor of using nuclear power plants. You may consider this from several perspectives, including (but not necessarily limited to) scientific, political, economic and social ideas and the benefits of using nuclear power plants.
d. Give at least three arguments against the use of nuclear power plants. You may consider this from several perspectives, including (but not necessarily limited to) scientific, political, economic and social ideas and any problems that arise from using nuclear power plants.
e. What do YOU think? Should we continue to use nuclear power to generate electricity? Give reasons for your stand.

Your paper should be typed and at least two full pages in length (double-spaced, 12 point or smaller type, one inch margins). However, any chemical structures may be hand-drawn.

All papers must contain a bibliography of at least three (3) appropriate references. Your Tro textbook may be cited, but you should also have other sources. You must give a complete reference for each source cited (authors, title, publisher, journal, pages, date, etc.). References for internet sites should also contain a web address for a link which connects to the site which you actually cite. Be sure to cite the relevant references in the body of your paper where appropriate.

This paper will be scored on the basis of 20 points and will be adjusted to 5 % of your final course grade. Please note that you will be penalized one point per day if your paper is submitted after the due date.