College/University: Stark State College of Technology

Course(s) Submitted: CHM142 General Chemistry 2 for OSC009

Date: 25 January 2007  
Course: 1  
of a 1  
Course OAN mapping.

Name and title of individual submitting on behalf of the college/university:

Name: Dr. Jeff Cramer  
Title: Department Chair & Professor, Science

Address: 6200 Frank Road NW, North Canton, OH 44720-7299

E-mail: jcramer@starkstate.edu

Phone: (330) 966-5457, ext. 4377

Fax: (330) 494-0571

Credit Hours: 5  
Lecture Hours: 3  
Laboratory Hours: 4  
Pre-Requisites(s) Course work (if applicable) CHM141

Placement Score (if applicable):

(Name of test)  
(Domain)  
(Score)

Catalog/Course Description (Includes Course Title and Course #):

CHM142 General Chemistry 2

The General Chemistry course is covered in two semesters. The second semester, CHM 142, is designed to strengthen and expand the student’s foundation in chemistry. Chemical concepts such as kinetics, thermodynamics, reaction equilibria, electrochemistry, and descriptive chemistry will be presented in the form of chemistry...
problems that bring together chemistry concepts and mathematical reasoning.

Texts/Outside Readings/Ancillary Materials


Course Objectives and/or Plan of Work

1. To investigate the types of intermolecular interactions
2. To calculate the energy involved in phase changes and highlight the effects of temperature and pressure with phase diagrams
3. To investigate the concepts of solutions and colligative properties and apply these concepts to biological macromolecules and the cell membrane
4. To apply the general ideas of bonding, structure, and reactivity to the main-group and transition elements to see how their chemical behavior correlates with their position in the periodic table
5. To investigate the special atomic properties of carbon and see how they relate to the complex structure and reactivity of organic molecules including synthetic and natural polymers
6. To understand the key factors that affect reaction rate and express rate in the form of a rate law
7. To understand how catalysts increase reaction rates by highlighting the reactions of a living cell and the depletion of atmospheric ozone
8. To examine the equilibrium state at the macroscopic and microscopic levels
9. To focus on the relation between the reaction quotient and the equilibrium constant and express the equilibrium condition in terms of concentrations
10. To understand how reaction conditions affect the equilibrium state using metabolism as a model
11. To understand the three definitions of acids and bases and to apply the principles of chemical equilibria to acids and bases
12. To examine the first and second laws of thermodynamics and the quantitative application of entropy (S)
13. To understand the relationship between free energy change and the equilibrium constant of a reaction
14. To examine the voltaic cell and understand how to use spontaneous reactions to generate electrical energy
15. To examine the electrochemical processes in batteries in terms of primary and secondary batteries and fuel cells
16. To learn and demonstrate safe and proper laboratory techniques using modern laboratory equipment
17. To observe and measure chemical reactions associated with organic chemical reactions, colligative properties, chemical kinetics, acid–base equilibria, and electrochemistry
18. To use above data to develop conclusions that will be presented in the form of a
<table>
<thead>
<tr>
<th>Description of Assessment and/or Evaluation of Student Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>See Attached Syllabus; Laboratory, Homework &amp; Quizzes, and Exams</td>
</tr>
<tr>
<td>Master Syllabi and Working Syllabi (if both are used)</td>
</tr>
</tbody>
</table>
CHM142 General Chemistry 2  
Science Department, General Studies Division  
Stark State College of Technology

Syllabus - Spring 2007

Instructor: Dr. Amy Jo Sanders, Ph.D.; Room G204m  
Ph 330-494-6170 x 4428  
Fax 330-494-0571

Office Hours: 
Tue: 12:00-2:00p, 4:00-5:00p  
Wed: 10:00a-1:00p  
Thurs: 12:00-2:00p, 4:00-5:00p  
Fri 2:00-3:00p

Please call or e-mail for appointment  
Email asanders@starkstate.edu  
Website http://www.starkstate.edu


Lab Manual: Experimental Chemistry Laboratory 142 ISBN

Course Description: The General Chemistry course is covered in two semesters. The second semester, CHM 142, is designed to strengthen and expand the student’s foundation in chemistry. Chemical concepts such as kinetics, thermodynamics, reaction equilibria, electrochemistry, and descriptive chemistry will be presented in the form of chemistry problems that bring together chemistry concepts and mathematical reasoning.

Course Objectives:
1. To investigate the types of intermolecular interactions
2. To calculate the energy involved in phase changes and highlight the effects of temperature and pressure with phase diagrams
3. To investigate the concepts of solutions and colligative properties and apply these concepts to biological macromolecules and the cell membrane
4. To apply the general ideas of bonding, structure, and reactivity to the main-group and transition elements to see how their chemical behavior correlates with their position in the periodic table
5. To investigate the special atomic properties of carbon and see how they relate to the complex structure and reactivity of organic molecules including synthetic and natural polymers
6. To understand the key factors that affect reaction rate and express rate in the form of a rate law
7. To understand how catalysts increase reaction rates by highlighting the reactions of a living cell and the depletion of atmospheric ozone
8. To examine the equilibrium state at the macroscopic and microscopic levels
9. To focus on the relation between the reaction quotient and the equilibrium constant and express the equilibrium condition in terms of concentrations
10. To understand how reaction conditions affect the equilibrium state using metabolism as a model
11. To understand the three definitions of acids and bases and to apply the principles of chemical equilibria to acids and bases
12. To examine the first and second laws of thermodynamics and the quantitative application of entropy (S)
13. To understand the relationship between free energy change and the equilibrium constant of a reaction
14. To examine the voltaic cell and understand how to use spontaneous reactions to generate electrical energy
15. To examine the electrochemical processes in batteries in terms of primary and secondary batteries and fuel cells
16. To learn and demonstrate safe and proper laboratory techniques using modern laboratory equipment
17. To observe and measure chemical reactions associated with organic chemical reactions, colligative properties, chemical kinetics, acid – base equilibria, and electrochemistry
18. To use above data to develop conclusions that will be presented in the form of a laboratory report

**Prerequisite:** CHM141 General Chemistry

**Academic Honesty:** The student is expected to present only his/her own work and reference the work and thoughts of others. This includes citing books, journals and Internet sources. Cheating, plagiarism, and other forms of academic dishonesty are described in the Student Handbook (p.21 Scholastic Honesty and Student Integrity and SSCT Catalog 2001-2003, p.25 “Honesty in Learning).

**Lab Attendance:** Missed labs may not be made up. If you are not present during the lab time, you will receive a 0. No make-up labs will be given under any circumstances. The lowest lab grade will be dropped.

**Safety:** It is the responsibility of the student to evaluate the risks associated with participation in a laboratory science course. Students may be exposed to chemicals including strong acids (H₂SO₄), strong bases (NaOH), volatile and flammable compounds (acetone, methanol, hexane), and heavy metals (mercury thermometers), as well as chemicals such as formaldehyde and glutaraldehyde which may have health effects after prolonged exposure.
Please refer to the MSDS (Material Safety Data Sheets) in each laboratory for further information regarding the potential hazards associated with this class. Students who are aware of these potential risks and use common sense will have a productive and safe learning experience in the laboratory. Our laboratory sections are designed to include basic introductory activities that are NOT associated with undue risk.

**Grading Scale:**

- **A** = 90.0 to 100%
- **B** = 80.0 to < 90.0%
- **C** = 70.0 to < 80.0%
- **D** = 60.0 to < 70.0%
- **F** < 60.0%

**Grading Criteria:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td>25%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>5%</td>
</tr>
<tr>
<td>Project</td>
<td>5%</td>
</tr>
<tr>
<td>Exam 1</td>
<td>15%</td>
</tr>
<tr>
<td>Exam 2</td>
<td>15%</td>
</tr>
<tr>
<td>Exam 3</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Exams:** Exams will include multiple choice, essay or short answer questions, and problems to be solved using dimensional analysis.

**Examination Make-up:** Exam make-up is only permitted under extraordinary circumstances with the instructor’s permission. Documentation may be required at the instructor’s discretion. The time and date of the make-up exam is at the instructor’s discretion. A penalty may be assessed at the instructor’s discretion. Penalty, if applied, shall not exceed 20% of the exam’s value. The make-up exam will evaluate the student’s learning for the same content, but the exam form shall be determined by the instructor. Students are to discuss absences with their instructors at the earliest possible date.

**Quizzes:** There will be a quiz for each chapter. They will be given the period after the chapter is completed. If you are not present during the quiz time, you will receive a 0. No make-up quizzes will be given under any circumstances. The lowest quiz grade will be dropped.

**Project:** Students will be required to complete a project on the main-group elements, transition elements, or coordination compounds. This project will be worth 5% of the course grade. The project criteria and due date will be provided at a later date.

**Lab:** There are 11 lab experiments for CHM 142. Students are required to participate in each lab experiment. Data is to be obtained and recorded in a laboratory notebook at the time of the
experiment. Laboratory notebooks with carbon paper are available in the bookstore. The
carbon copies of the day’s experimental observations and data will be turned in to the instructor
on the day of the experiment. Students will retain the original data and use it to make
calculations. The data and calculations will be presented to the instructor in the form of a
written lab report. Please see the handout “Format of Laboratory Reports.” The reports are due
the week following the experiment. Each lab experiment will be worth 100 points. Grades for
each lab will be determined as follows:
Lab safety and technique 35 points
Accuracy of data 5 points
Lab report 60 points

-------------
100 points

There will be two lab exams. These 100 point exams are designed to cover the experimental
techniques and learning objectives of the labs preceding the exams. The total number of points
possible for the lab is 1300. The lowest lab or practical grade will be dropped for a final total of
1200 points. The final lab grade will be worth 25% of the total course grade. Students must
obtain at least 720 points in lab in order to receive a passing grade for the course.

### Schedule of Topics (Tentative) - CHM142 General Chemistry 2

<table>
<thead>
<tr>
<th>Class #</th>
<th>Tentative Dates</th>
<th>Chapter</th>
<th>Topics/Reading Assignments</th>
</tr>
</thead>
</table>
| 1       | 17 Jan          | 12      | Syllabus
12.1 Phase Changes
12.2 Quantitative aspects of Phase Changes |
| 2       | 19 Jan          | 12      | 12.2 Quantitative aspects of Phase Changes
12.3 Types of Intermolecular Forces |
| 3       | 24 Jan          | 12      | Quiz Chapter 12
13.1 Types of Solutions
13.2 Intermolecular Forces and Biological Macromolecules |
|         |                 | 13      |                             |
| 4       | 26 Jan          | 13      | 13.4 Solubility as an Equilibrium Process
13.5 Quantitative Ways of Expressing Concentration |
| 5       | 31 Jan          | 13      | 13.5 Colligative Properties of Solutions |
| 6       | 2 Feb           | 13      | Quiz Chapter 13
15.1 Carbon and Organic Molecules
15.2 The Structures and Classes of Hydrocarbons |
|         |                 | 15      |                             |
| 7       | 7 Feb           | 15      | 15.3 Classes of Organic Reactions
15.4 Properties and Reactivities of Functional Groups |
| 8       | 9 Feb           | 15      | 15.5 Synthetic Macromolecules
15.6 Biological Macromolecules |
| 9       | 14 Feb          | 15      | Quiz Chapter 15
Review |
<p>| 10      | 16 Feb          | 12,13,15| Exam I  Chapters 12, 13, 15 |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Topics</th>
</tr>
</thead>
</table>
| 21 Feb  | 16.1 Factors that Influence Reaction Rate  
16.2 Expressing the Reaction Rate  
16.3 Rate Law and Its Components |
| 23 Feb  | 16.3 Rate Law and Its Components  
16.8 Catalysis: Speeding Up a Chemical Reaction |
| 27 Feb  | Quiz Chapter 16  
17.1 Equilibrium State and Constant  
17.2 The Reaction Quotient |
| 2 March | 17.4 Reaction Direction: Comparing Q and K  
17.5 How to Solve Equilibrium Problems |
| 7 March | 17.5 How to Solve Equilibrium Problems  
17.6 Le Chatelier’s Principle |
| 9 March | Quiz Chapter 17  
18.1 Acids and Bases in Water  
18.2 Autoionization of Water and the pH Scale |
| 14 March| 18.3 Bronsted-Lowry Acids  
18.5 Weak Bases and Weak Acids |
| 16 March| 18.9 Lewis Acids  
Review |
| 18 March| Spring Break |
| 28 March| Exam II Chapters 16 - 18 |
| 30 March| 20.1 The 2nd Law of Thermodynamics |
| 4 April | 20.3 Entropy, Free Energy, and Work |
| 6 April | Good Friday – College Closed |
| 11 April| 20.4 Free Energy Equilibrium and Reaction Direction |
| 13 April| Quiz Chapter 20  
21.2 Voltaic Cells |
| 18 April| 21.5 Electrochemical Processes in Batteries  
Fuel Cell Supplement |
| 20 April| Quiz Chapter 21  
Review |
| 25 April| Exam III Chapters 20, 21 |
| 27 April| Project Presentations |
| 2 May  | Project Presentations |
| 4 May  | Review |
| 11 May | Comprehensive Final Exam |
## Lab Schedule (Tentative)
### CHM42 General Chemistry 2

<table>
<thead>
<tr>
<th>Lab #</th>
<th>Date (Tentative)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Introduction to Laboratory, Safety in the Lab, Experiment 1: Cooling Curves and Crystal Structures</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Experiment 2: Molecular Weight Determination by Freezing Point Depression</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Experiment 3: Peptides and Amino Acids</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Experiment 4: Synthesis of Organic Polymers</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Experiment 5: Qualitative Analysis of Group I,II,III Cations</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Experiment 5: Continued, Open lab – Review for Practical I</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Lab Practical I</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Experiment 6: Rates of Chemical Reactions, The Iodinatin of Acetone</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Experiment 7: Properties of Systems in Chemical Equilibrium – Le Chatelier’s Principle</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Experiment 8: pH Measurements – Buffers and Their Properties</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Experiment 9: Acids and Bases – Reactions and Standardizations</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Experiment 10: Thermodynamics: Determining the Energy of a Reaction</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Experiment 11: Understanding Fuel Cells</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Experiment 11: Continued, Open Lab – Review for Practical II</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Lab Practical II</td>
</tr>
</tbody>
</table>

### College Wide Student Outcomes

Stark State College has identified five college wide general education goals which represent the knowledge, skills, and abilities needed by students who graduate from our institution. The goals indicated are addressed in this course.

1) Communication Skills (Written/Oral)
2) Computational Skills
3) Computer Literacy Skills
4) Critical Thinking Skills
5) Interpersonal Skills/ Professionalism
Additional Documentation

None

<table>
<thead>
<tr>
<th>OBR Use</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved</td>
<td></td>
</tr>
<tr>
<td>Additional Information Requested</td>
<td></td>
</tr>
<tr>
<td>Rejected</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
</tr>
</tbody>
</table>
Ohio Articulation Number Form Directions

This form is used to submit your course information to the Ohio Board of Regents, for all courses that make up OAN requirements. This document is a form, so the only fields that need to be filled in can be. When you open this, make sure the top of the screen, where the name of the document is displayed, says “Document1” or something similar to that. When you open this form from a location other than inside of word, it creates a blank template to fill in. Please fill it in with the appropriate course information from your institution. All of the fields in this document are expandable, and will grow to fit as much data in them as you need.

Once you are done submitting your course information, you need to save this file. Since Word opened a blank version of this file, so you will need to rename it to save it. Under file, choose “Save as” and then input the name of the file. The naming scheme for this form is Institution-Year-OAN number-Course Title.

Example, if you were ABC Community College, and you were submitting your Calculus110 course, the name of the file would be ABC-2005-OMT005-Calculus110. If two (or more) courses are required to fulfill that same OAN, you would submit ABC-2005-OMT005-Calculus110Calculus111.

When you are done with your submissions, please send them electronically to the Ohio Board of Regents so we can keep your information on file.