## Term Information

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| **Effective Term** | Summer 2014 |

## General Information

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| **Course Bulletin Listing/Subject Area** | Chemistry |
| **Fiscal Unit/Academic Org** | Chemistry - D0628 |
| **College/Academic Group** | Arts and Sciences |
| **Level/Career** | Graduate |
| **Course Number/Catalog** | 6050 |
| **Course Title** | Modeling instruction in chemistry |
| **Transcript Abbreviation** | Mod Instr Chem |
| **Course Description** | An inquiry-based course addressing both content learning and supporting pedagogy in chemistry instruction suitable for high school instructors implementing a modeling-based approach. |
| **Semester Credit Hours/Units** | Fixed: 6 |

## Offering Information

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| **Length Of Course** | 7 Week |
| **Flexibly Scheduled Course** | Always |
| **Does any section of this course have a distance education component?** | No |
| **Grading Basis** | Letter Grade |
| **Repeatable** | Yes |
| **Allow Multiple Enrollments in Term** | No |
| **Max Credit Hours/Units Allowed** | 18 |
| **Max Completions Allowed** | 3 |
| **Course Components** | Laboratory, Lecture |
| **Grade Roster Component** | Lecture |
| **Credit Available by Exam** | No |
| **Admission Condition Course** | No |
| **Off Campus** | Always |
| **Campus of Offering** | Columbus |

## Prerequisites and Exclusions

**Prerequisites/Corequisites**

**Exclusions**

## Cross-Listings

**Cross-Listings**

## Subject/CIP Code

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| **Subject/CIP Code** | 40.0501 |
| **Subsidy Level** | Professional Course |
| **Intended Rank** | Professional |

## Quarters to Semesters

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| **Quarters to Semesters** | New course |
| **Give a rationale statement explaining the purpose of the new course** | To meet a need for the professional development of teachers, predominantly at the High School-level, seeking to improve their skills in chemistry instruction in an inquiry-based format. |
| **Sought concurrence from the following Fiscal Units or College** | |

## Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

## Course Details

**Course goals or learning objectives/outcomes**

- Capable of implementing a modeling-based instructional style in chemistry at the high school level.
- Able to design supporting activities and laboratory experiments.
- Able to lead student-centered discussions involving conceptual models.

**Content Topic List**

- Classroom pedagogy
- Particle description of matter
- Stoichiometry
- Atomic models
- The role of energy in chemical reactions
- Acid/base chemistry
- Gas-laws

## Attachments

- Chem 6050 syllabus_Jan2014.docx: Course syllabus

  *(Syllabus. Owner: Woodward,Patrick Marvin)*

## Comments

- There was a typo in the syllabus it is meant to be a 6-credit offering. A description of the format of the course is given below.

  The course offering is an intense 3-week workshop combining inquiry-based laboratory experiments, in-class discussion, and evidence-based pedagogy to support the professional development of the participants. The workshop meets full-time each week day. Assignments, including readings, lesson-plans, reflections, and additional projects are required most evenings. The contact time during the week is approximately 40 hours (e.g. 8am-4pm with working lunch), with an additional 1-3 hours of nightly homework. *(by Woodward,Patrick Marvin on 01/09/2014 07:44 PM)*
- The course request lists this as a 6 unit course but the syllabus indicates 4 semester credits. Also, the syllabus indicates the dates to suggest a three-week offering yet the request indicates 7 weeks. Typo? Please clarify or correct. It might assist the review process if a brief description of the course format is include. For example, how is the lecture and laboratory component time to be distributed? *(by Swenson,Richard Paul on 12/03/2012 11:10 AM)*

## Workflow Information

| Status | User(s) | Date/Time | Step |
|---|---|---|---|
| Submitted | Woodward,Patrick Marvin | 11/27/2012 12:22 PM | Submitted for Approval |
| Revision Requested | Swenson,Richard Paul | 12/03/2012 11:10 AM | Unit Approval |
| Submitted | Woodward,Patrick Marvin | 01/23/2014 06:26 PM | Submitted for Approval |
| Approved | Woodward,Patrick Marvin | 01/23/2014 06:27 PM | Unit Approval |
| Approved | Hadad,Christopher Martin | 01/24/2014 09:14 AM | College Approval |
| Pending Approval | Vankeerbergen,Bernadette Chantal<br>Nolen,Dawn<br>Jenkins,Mary Ellen Bigler<br>Hogle,Danielle Nicole<br>Hanlin,Deborah Kay | 01/24/2014 09:14 AM | ASCCAO Approval |

**Chemistry 6050**
**CHEMISTRY FOR IN-SERVICE TEACHERS**

Modeling Instruction for Physical Science and Chemistry in Ohio Summer Workshop
New Albany High School
June 9th -27th
6-credit hours

Instructor: Dr. Ted M. Clark
Co-Instructors: Liz Emmer and Stacey Raymond

Course Rationale: This workshop aims to improve secondary science teacher preparation by enhancing their content understanding, science-instruction pedagogy and lesson planning skills. This will be accomplished by introducing a Modeling Instruction Framework with a focus on the physical sciences. An emphasis will be placed on explicitly addressing many state-mandated academic benchmarks, including aspects of scientific inquiry, scientific ways of knowing, and physical science.

| **Date** | **Topics** | **Homework** |
|---|---|---|
| Monday<br>June 9th | Introduction to Modeling Chemistry<br>Paperwork and Pre-Testing<br>Unit 1: Simple Particle - Describing Matter (Lab expectations, Graphing, Volume) | Read and Reflect: Gillespie; "Great Ideas of Chemistry" |
| Tuesday | Gillespie Article Discussion<br>Unit 1: Simple Particle - Describing Matter (Mass, Density) | Unit 1 Response Journal |
| Wednesday | Unit 1: Simple Particle - Describing Matter (Assessment and Application)<br>Unit 2: Simple Particle - Energy and States, part 1 (Motion, Temperature) | Read and Reflect: Bowen and Bunce; "Testing for Conceptual Understanding in Chemistry" |
| Thursday | Bowen and Bunce Article Discussion<br><br>Unit 2: Simple Particle - Energy and States, part 1 (Temperature, Pressure, Gas Laws) | Read and Reflect: Harrison and Treagust "Secondary Students' Mental Models of Atoms and Molecules: Implications for Teaching Chemistry" due 5/17 |
| Friday | AM Speaker: Doug Vallette<br>Unionville High School, Kennett Square, PA<br><br>Unit 2: Simple Particle - Energy and States, part 1 (Gas Laws) | Read and Reflect: Harrison and Treagust "Secondary Students' Mental Models of Atoms and Molecules: Implications for Teaching Chemistry" due 5/17<br>Unit 2 Response Journal<br>* Composition Book Collection |
| Monday<br>June 16th | Harrison Article Discussion<br><br>Unit 3: Energy and States, part 2 (Heat, LOL's,) | Read and Reflect: Criswell; "Do you See what I see? Lessons about the Role Of Models in High School Chemistry Classrooms"<br><br>Unit 3 Response Journal |
| Tuesday | Criswell Article Discussion<br>Unit 4: Bonded Particles - Describing Substances (Mixtures, Compounds, Separations) | Unit 4 Response Journal |

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| Wednesday | Unit 5: Counting Bonded Particles - The Mole (Relative Mass, Empirical Formula) | Unit 5 Response Journal |
| Thursday | Unit 6: Particles with Internal Structure (Charged Particles, Solids )<br><br>Red Carpet Day: Invite your Administrator | Read and Reflect: Nyachwaya, "The Development of an open-ended drawing tool" |
| Friday | Nyachway Article Discussion<br><br>Unit 6: Particles with Internal Structure | Lesson Plan<br><br>* Composition Book Collection |
| Monday<br>June 23rd | Unit 7: Representing Chemical Energy – Particles and Energy (Balancing, Reactions) | Read and Reflect: Davidowitz, "What Can Student-generated Diagrams Tells Us about Their Understanding of Chemical Equations?" |
| Tuesday | Davidowitz Article Discussion<br><br>Unit 7: Representing Chemical Energy – Particles and Energy (LOLOL's)<br><br>Unit 8: Stoichiometry 1 (BCA, Moles) | Read and Reflect: Lee, "A Comparison of University Lecturers' and Pre-service Teachers' Understanding of a Chemical Reaction at the Particulate Level."<br><br>Unit 7 Response Journal |
| Wednesday | Unit 8: Stoichiometry 1 (Moles, Percent Yield, Conservation) | Read and Reflect: Gooding and Metz, "From Misconceptions to Conceptual Change"<br><br>Unit 8 Response Journal |
| Thursday | Gooding Article Discussion<br><br>Unit 9: Stoichiometry 2 (Solutions, Gases, Energy)<br><br>PM Speaker: Steve Cessna;<br>Eastern Mennonite<br>University; Harrisonburg, Virginia | Read and Reflect: Gabel, "Improving Teaching and Learning through Chemistry Education Research: A Look to the Future"<br><br>* Composition Book Collection |
| Friday, | Gabel Article Discussion<br><br>Unit 9: Stoichiometry 2<br><br>Paperwork and Post-Testing | |

**STUDENT GRADES**: Attendance is mandatory for satisfactory completion of the workshop.

Students will maintain reflective journals and notebooks. Contributions to these, and class discussions, will be evaluated. In-class worksheets will be completed by students. Post-testing of content knowledge will follow each unit. In-class performance will constitute 75% of the student's overall grade, with out-of-class assignments contributing 25%.

**Grading Scale:**

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| A > 93% | A- > 90% | B+ > 88% | B > 82% | B- > 80% |
| C+ > 78% | C > 72% | C- > 70% | D+ > 68% | D > 62% (<62%=E) |

**Assignments:**

**Reading Reflection Requirements:** These need to be submitted electronically prior to the day's discussion (paper copies will be accepted as needed).

**Unit Response Journal Requirements:** Read through ALL of the unit materials including the ones that were not used in class. In your composition notebook:

1. Summarize the big ideas that were covered in the unit (what should be developed as part of the model by students).
2. List misconceptions from the Kind article, "Beyond Appearances", that match the goals of this unit.
3. What would you use in the classroom? Explain.
4. What are you hesitant about Explain.

** These are informal (and can be written as lists) but should be written on (or typed and glued in on the teacher pages in your composition notebook.

**Lesson Plan:** Modify a ONE class (45- 50 minuets, NOT a block) lesson plan to fit into the modeling framework. Choose a worksheet, demo or activity that you currently like to complete with your students.

1. Briefly describe the activity (or share a copy of the worksheet, etc).
2. Explain how you would adapt it for a modeling classroom.
3. Include a list of big ideas you hope to elicit from students during the class. list ( 2-3 key ideas in a 45 minute period is usually perfect)
4. Compile a list of questions you would use to prompt students.
5. List and explain a few ideas of what students may get wrong or misconceptions they have about the content (either developed through our class or whet you have seen in the past)

**Course Readings:** (required and supplemental are listed)

Bowen, Craig W., and Diane M. Bunce. "Testing for Conceptual Understanding in General Chemistry1." *The Chemical Educator* 2.2 (1997): 1-17.

Clark, Ted M., Jason Cervenec, and Jessica Mamais. ""The Price Is Right" for Your Classroom." *Journal of Chemical Education* 88.4 (2011): 428-31.

Davidowitz, Bette, Gail Chittleborough, and Eileen Murray. "What Can Student-generated Diagrams Tells Us about Their Understanding of Chemical Equations?" *Proceedings of the*

*18th Annual Meeting of the Southern African Association for Research in Mathematics, Science and Technology Education : Crossing the Boundaries*. Southern African Association for Research in Mathematics, Science and Technology Education. Conference, Pinetown. Durban: University of Kwazulu-Natal, 2010. 51-58.

Gabel, Dorothy. "Improving Teaching and Learning through Chemistry Education Research: A Look to the Future." *Journal of Chemical Education* 76.4 (1999): 548.

Gillespie, Ronald J. "The Great Ideas of Chemistry." *Journal of Chemical Education* 74.7 (1997): 862.

Gooding, Julia and Bill Metz. "From Misconceptions to Conceptual Change: Tips for Identifying and Overcoming Students' Misconceptions." *The Science Teacher* April/May (2011) 34-37.

Harrison, Allan G., and David F. Treagust. "Secondary Students' Mental Models of Atoms and Molecules: Implications for Teaching Chemistry." *Science Education* 80.5 (1996): 509-34.

Kind (Barker), Vanessa. *Beyond Appearances: Students' Misconception about Basic Chemical Ideas*. Rep. 2nd ed. London: Royal Society of Chemistry, 2004.

Kronik, Leeor, Tami Levy Nahum, Rachel Mamlok-Naaman, and Avi Hofstein. "A New "Bottom-Up" Framework for Teaching Chemical Bonding." *Journal of Chemical Education* 85.12 (2008): 1680.

Lee, Kam-Wah L. "A Comparison of University Lecturers' and Pre-service Teachers' Understanding of a Chemical Reaction at the Particulate Level." *Journal of Chemical Education* 76.7 (1999): 1008-012.

Nyachwaya, James M., Abdi-Rizak Mohamed, Gillian H. Rowhrig, Nathan B. Wood, Anne L. Kern, and Jamie L. Schneider. "The Development of an Open-ended Drawing Tool: An Alternative Diagnostic Tool for Assessing Students' Understanding of the Particulate Nature of Matter." *Chemical Education Research and Practice* 12 (2011): 121-32.

Talanquer, Vicente. "Commonsense Chemistry: A Model for Understanding Students' Alternative Conceptions." *Journal of Chemical Education* 83.5 (2006): 811.

Whitfield, Mary, and Ed Vitz. "Demonstrating Void Space in Solids: A Simple Demonstration To Challenge a Powerful Misconception." *Journal of Chemical Education* 83.5 (2006): 749.

## Disability Services (ODS)

All students with documented disabilities, who need accommodations, should see the instructor privately. If your disability requires materials in alternative formats, please contact the Office for Disability Services (ODS) at 292-3307, Room 150 Pomerene Hall.

### STANDARDS OF ACADEMIC CONDUCT IN GENERAL CHEMISTRY

**Any material submitted in General Chemistry must represent your own work. Violations of this standard will be referred to the University Committee of Academic Misconduct (COAM) as required by Faculty Rules**.

It is the responsibility of COAM to investigate all reported cases of student academic misconduct; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations, quizzes, and graded assignments. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information see the Code of Student Conduct, http://studentaffairs.osu.edu/pdfs/csc_12-31-07.pdf.

The Department of Chemistry will recommend as the **minimum penalty a grade of E for the course for any such violations**. Students supplying materials for others to "look at" may be charged with academic misconduct. You should not assist others in violations of academic standards. "I didn't know that the person was going to copy my work" is not an acceptable excuse.