Discovery Program Course Proposal Form
(including Course Conversions)

Course Title: Chemistry & Society
Course Number: 409 Credit Hours 4
Faculty Name: Christopher F. Bauer
Dept/Program: Chem
College/School: CEPS
Semester to be implemented: Spring 2010
E-mail: chris.bauer@unh.edu

If applicable:
Current Gen Ed Category: ___3P___
Currently Writing Intensive: ___Yes X___ No

PROPOSED DISCOVERY CATEGORY: (check no more than two)

___ Biological Sciences
___ Fine and Performing Arts
___ Humanities
___ Social Sciences
___ Environment, Technology, and Society
___ Historical Perspectives
___ Physical Sciences
___ World Culture

OR: ______ Quantitative Reasoning (Complete the QR form and not the following two questions.)

The proposed course may be the only one a student takes in this category. The ten courses required in Discovery comprise a curriculum in which each course represents not only its home discipline, but also teaches students about relationships to cognate or other fields:

1. How does this course help students understand the category which it represents?
(If you are asking for approval for more than one category, please respond separately for each.)

Next page

2. How does this course make explicit the relationships amongst related—and perhaps even distant—fields or disciplines?

Next page

Please submit the following documents:

<table>
<thead>
<tr>
<th>Required for conversion only</th>
<th>Required for new or modified courses</th>
<th>Supplemental (as applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>___ Current catalogue description</td>
<td>___ UNH course approval form</td>
<td>___ Writing Intensive Form</td>
</tr>
<tr>
<td>X Syllabus</td>
<td>X Catalogue description</td>
<td>X Inquiry Form</td>
</tr>
<tr>
<td></td>
<td>Syllabus</td>
<td>Lab Designation Form</td>
</tr>
</tbody>
</table>
Physical Sciences

How does this course help students understand the category which it represents?

The course starts with everyday experiences, generates questions of interest, and explores how chemical substances, properties, and principles operate within those contexts. The topics of discussion are essentially a subset of the same topics that occur in Chem 403/404, but at a predominantly descriptive and qualitative level, relying only to a small degree on mathematical facility. Hands-on activities are used to support these explorations, but these are shorter and more qualitative in nature compared with a more formal laboratory investigation. Nevertheless, the purpose is to explore and test ideas, in the way that scientists do.

How does this course make explicit the relationships amongst related—and perhaps even distant—fields or disciplines?

The syllabus makes it clear that the questions to be explored consist of pragmatic and everyday curiosities, which necessarily require thinking about contexts other than just chemistry – agriculture (farming, irrigation, fertilization), nutrition (essential nutrients, hydration, cooking), law (criminal investigation), recycling (plastic bottles), cleaning (laundry soap, solvents), sports (ice fishing)
This description is not useful and is in process of being changed. The proposed new description is below.

Catalogue Description (current)
CHEM 409 - Chemistry and Society
Credits: 4.00
Elementary survey of chemistry; integrates principles and applications. Not a prerequisite for any other chemistry courses. Includes lab like activities during class time. (Not offered every year.) Cannot be taken for credit if credit received for CHEM 401, 403, or 405.

Catalogue Description (proposed new)
CHEM 409 - Chemistry and Society
Credits: 4.00
An inquiry-oriented introductory course in basic chemistry concepts as applied to the everyday world and issues in the news. Suited to students pursuing elementary certification, or anyone needing a Physical Science elective. Not a prerequisite for any other chemistry courses. Includes hands-on experimental activities during class time. Cannot be taken for credit if credit received for CHEM 401, 403, or 405.
The Inquiry requirement can be met either with Inquiry 444 courses or with Inquiry attribute courses. Please show evidence of the following in your syllabus and proposal materials.

All Inquiry 444 courses or Inquiry attribute courses must contain four individually necessary and collectively sufficient features:

1. Inspire curiosity. An Inquiry student will compose open-ended questions that lead to further investigation into increasingly focused problems and issues.

2. Develop understanding and perspective taking: An Inquiry student will explain a central issue or question of the course using at least two unique perspectives.

3. Clarify standards of thinking: An Inquiry student will be able to identify, compare, and evaluate different interpretations (hypotheses, explanations) of a given phenomenon.

4. Create effective communicators: An Inquiry student will present in clearly organized form the results of the investigation into questions or problems they have posed.

In addition:

- All designated Inquiry 444 course enrollments must be capped at 25.

- All designated Inquiry attribute courses must be capped at no higher than 25 or 35 students in a) total course enrollment, or b) weekly discussion sessions, labs, or other interactive contexts.

- All Inquiry attribute courses must be lower-division (i.e., 400- or 500-level) courses.

- Inquiry 444 and Inquiry attribute courses also may count for writing intensive and disciplinary breadth requirements.

- Academic departments can decide whether the Inquiry 444 and Inquiry attribute courses that they offer also can count toward course credits within their majors.

For more information about Inquiry, go to the UNH Discovery Program website.
Justification for Inquiry Attribute

Chemistry and Society is an inquiry-oriented introductory course designed to provide students a background in basic chemistry concepts while encouraging them to see connections between those concepts and the larger world around them. A series of 5 or 6 learning units is planned for the 14-week semester:

- Water quality and toxic sludge
- Foods we eat and where they come from: nutrition and industrial agriculture
- Heating your home, powering your car: energy resources in the age of peak oil
- Plastic bottles: how we produce them, where they go
- Chemicals in your kitchen and under the bathroom sink
- Air, weather, and the global warming debate

Learning units will be presented according to the following general pattern:

1) Students are presented with a question or challenge related to the topic. For example, in Unit 1, students see a film excerpt about a coal sludge spill affecting a rural community in Tennessee. Student groups are then asked “How would you clean up a sludge spill?” The purpose of the question is to inspire curiosity, an initiate brainstorming.

2) In groups, students design an experiment or laboratory procedure to answer their question or enact their proposal. In the Unit 1, students are presented with a flask of “sludge water,” which they are charged with separating into its component parts. The intent of this unit is to inspire thinking about how mixtures could be separated based on the differing properties of the substances they contain. Students record their hypotheses, procedures, results, and conclusions in laboratory notebooks.

3) In a follow-up discussion period, groups present their results and questions. Frequently, laboratory activities generate conflicting results, or observations that call for further exploration. Students evaluate their own and other groups’ explanations. They analyze laboratory procedures and results for sources of error, underlying assumptions, and differing possible explanations.

4) Additional background material on the relevant chemistry concept is provided to solidify the discussion, and provide a launch point for another round of inquiry. For example, in Unit 1 after students have been presented with some information about different types of substances, they are asked “What’s in the water you drink?”
The course structure fulfills the features of Inquiry attribute courses in the following manner:

1) *Inspire curiosity.* Units are initiated with challenges or questions pertaining to chemistry-related social issues. Students are guided to develop answers to these questions through a process that leads to discovery of underlying chemical principles.

2) *Develop understanding and perspective taking.* By its nature, the course examines each learning unit both from the perspective of the societal issues the underlying science concepts involved. Students are charged not just with understanding fundamental chemistry, but further with making decisions about how to use that understanding. In addition, for the “portfolio” portion of their course grade, students are charged with investigating independently a chemistry-related social issue of their choosing.

3) *Clarify standards of thinking.* Laboratory activities charge students with obtaining and explaining their results, and comparing their results with those of their classmates. Students are also encouraged to evaluate explanations of related science phenomena they see in the news.

4) *Create effective communicators.* Communication skills are developed in a variety of contexts. Students typically work in groups with defined roles (see syllabus under “Group work structure”) to given them practice in different aspects of group activity. Class discussions of laboratory results encourage students to voice their questions and explain their answers. Students write reports of their laboratory activities that clarify the details of the procedure, results and conclusions. In addition, after each class meeting, students write a “reflection” that analyzes their own understanding of the chemistry concepts explored, and encourages them to make connections between those concepts and the everyday world they inhabit. These reflections often form a launch point for students to generate their independent “portfolio” project; they report on the results of their project in an oral presentation to the class.
Course Description:

Chemistry and Society is an introductory chemistry course for the curious non-scientist. The course explores the chemistry underlying everyday life, and in doing so reveals basic principles about how matter—the stuff everything is made of—behaves. We focus on a series of current political issues in science, ranging from food and agriculture to weather and global warming, and in that context examine chemistry concepts like atomic and molecular structure, chemical bonding, and phase change.

The main intent of the course is to introduce students to the fun of laboratory discovery, and give them confidence in their abilities to connect chemistry with the world around them. Numerous hands-on lab activities give students a chance to explore chemical principles in a setting that is cooperative and discovery-oriented. Class discussion encourages students to brainstorm links between their experiments and the science debates they see in the news. The class culminates with a round-table analysis of how we as citizens make science policy decisions, both for better and for worse.

Chem 409 fulfills a General Education Physical Science requirement. 4 credits. Enrollment is limited to 24 students.

Probable topics include:

- Water quality and toxic sludge
- Foods we eat and where they come from: nutrition and industrial agriculture
- Heating your home, powering your car: energy resources in the age of peak oil
- Plastic bottles: how we produce them, where they go
- Chemicals in your kitchen and under the bathroom sink
- Air, weather, and the global warming debate

Meeting times:  Mon and Wed, 10 am-12 noon
Spring 2010

Instructor: Dr. Katharine Winans

Office: 214 Parsons
Phone: 862-0237
Email: k.winans@unh.edu
Grading

15% Participation
35% Notebook
   --notes and reports from experiments/exercises
   --reflections on class work
   --assignments
   --other
15% Tests
20% Portfolio
15% Observation journal

Participation:
This course is hands-on and discussion-rich. Come to class prepared to participate actively in classroom activities; that means doing reading/"legwork" beforehand.

Notebook:
It’s critical that you keep track of where we’ve been and why. Since we will move among a variety of activities—presentation, lab activities, discussions—you will need to invest time in documenting, organizing, and reviewing what happened each class day. After class, review and expand your notes as necessary. You should conclude your notes on each class meeting with a "reflection" section (½-1 page long) that extends the chemistry content of the class, and makes broader connections to the world. (Don’t just summarize the day’s events!) Your notebook should also include handouts or exercises you complete (some of these will be group efforts). Use either a three-ring binder, to which you can add handouts, or a spiral-bound notebook with a folder. Notebooks will be collected and graded for completeness, accuracy, and thoughtful analysis on the following dates:

Tests:
Two or three tests during the semester; specifics to be announced.

Portfolio:
This will be divided in two parts—(1) A collection of items that you consider your best work during the semester, along with a justification for inclusion. This is intended to show me the intellectual work to which you can aspire. Focus on quality, not quantity.
(2) New work you complete independently on a topic you develop during the semester. The format is flexible (we will discuss this more as the semester progresses). You may find that your notes and reflections from class, and your observation journal (see below) help you develop the ideas and content for this project. You will report on your project in an oral presentation to the class.

Observation journal:
Science seeks to explain how and why stuff happens...to do that, one first must notice what happens. Please purchase a small, bound notebook (separate from your class notes) for this journal. Your task for 20-30 minutes, three times a week (ideally, every
other day), is to record—in detail—your observations of the natural world. “The natural world” is a broad subject; typically, I’ll give you some question prompts as to what you might observe each week, but you will also have latitude to explore your own interests.

**Group work structure**

Much of the time, you’ll complete class work in groups. In some ways, this makes life easier—two (or three, or four) heads are better than one. In some ways, it makes life harder—it can be tough to express one’s tentative ideas aloud, and sometimes personality conflicts arise within a group.

Cashing in on group work’s benefits, and navigating its challenges, is a skill that many employers seek when they screen job candidates. To help you develop this skill, we will often use a structure where group members have assigned roles. This simplifies your task within the group.

**Roles:**

- **Manager**: Manages the group. Ensures that members are fulfilling their roles, that the assigned tasks are accomplished in reasonable time, and that all group members participate and improve their understanding.

- **Recorder**: Records the date, and names and roles of group members. Records observations and insights and anything else important to documenting what is covered and discovered. These notes will be posted on Blackboard, and thus will be available to everyone. Each group member should print a copy of his/her group’s notes, and include it in his/her notebook.

- **Presenter**: Presents oral reports to the class. These should be as concise as possible.

- **Reflector**: Observes and comments on group dynamics and behavior with respect to the learning process. Specifically, the reflector should note: (1) strengths, (2) areas for improvement, and (3) insights you may have noticed about the process of group work. The reflector’s report (often written, sometimes oral) is returned to the instructor.