- Course Information -

University:	University of Nebraska at Omaha
College:	Graduate College
Cognizant:	Arts and Sciences
Curriculum:	Chemistry
Number:	8040
Type:	Seminar
Title:	Seminar in Teaching Advanced Placement Chemistry
Effective term:	Summer 2009
Graduate non-degree students:	Allowed
Can course be taken for credit multiple times?	No

- Credit Hours Information -

Type:	Fixed
Hours:	2

- Duplicate Information -

Curriculum:

- Cross Listing Information -

Courses:

- 1.0 Course Description Information -

1.1 Catalog description:

This course provides an introduction to the Advanced Placement high-school chemistry course and includes instruction on content and methods specific to teaching an Advanced Placement chemistry course. Emphasis will be placed on subject content and adaptations of college-level laboratory experiments to the high-school level.

1.2 Prerequisites of the course:

Concurrent enrollment in the Advanced Placement Chemistry Institute at UNO and current employment as a high-school science teacher or instructor permission.

1.3 Overview of content and purpose of the course:

The College Board requires that teachers who teach Advanced Placement (AP) chemistry be trained to do so. The AP Chemistry Institute fulfills the College Board's requirement. However, some of the teachers attending the institute also seek graduate credit. Active participation in the week-long institute and a follow-up paper on applications in the classroom will give teachers a substantial start in implementing an appropriate curriculum for their AP chemistry students. The course has been taught as a special topics course as needed. Three students out of approximately thirty-two participants in the AP Chemistry Institute have received graduate credit via the special topics course.

1.4 Unusual circumstances of the course:

The course may be offered only in conjunction with an Advanced Placement Chemistry Institute.

- 2.0 Course Justification Information -

2.1 Anticipated audience / demand:

High school teachers working toward an advanced degree in education with an interest in teaching Advanced Placement chemistry.

2.2 Indicate how often this course will be offered and the anticipated enrollment:

The course will be offered on demand during the summer. Based on past enrollment in the special topics course, the demand will be approximately one student per year.

2.3 If it is a significant change to an existing course please explain why it is needed:

This course will be a new offering.

- 3.0 Objective Information -

3.1 List of performance objectives stated in learning outcomes in a student's perspective:

3.1.1 Student will understand the structure and content of the Advanced Placement chemistry test.
3.1.2 Student will understand how to construct a course to satisfy College Board requirements and the Advanced Placement audit.
3.1.3 Student will be able to make the distinction between a high-school chemistry and a college-level chemistry course in both content and methods.
3.1.4 Student will design a course to satisfy College Board standards.
3.1.5 Student will gain insight on how to adapt college-level chemistry laboratory experiments to meet the constraints of high-school scheduling.
3.1.6 Student will know the laboratory skills required of the college-level chemistry student.

- 4.0 Content and Organization Information -

4.1 List the major topics central to this course:

The content in a representative sequence includes

- 4.1.1 Overview of the Advanced Placement (AP) chemistry course
  - 4.1.1.1 College Board roles in AP chemistry
  - 4.1.1.2 Sample syllabi and exams
  - 4.1.1.3 AP Audit/Accreditation of teacher and school
  - 4.1.1.4 Structure and scoring of the AP chemistry exam
- 4.1.2 Content of the AP chemistry exam
  - 4.1.2.1 Basic atomic structure
  - 4.1.2.2 Chemical nomenclature
  - 4.1.2.3 Quantum theory and electronic structure
  - 4.1.2.4 Periodic properties of the elements
  - 4.1.2.5 Chemical bonding
  - 4.1.2.6 Molecular structure and geometry
  - 4.1.2.7 Valence-bond and molecular-orbital bonding theory
  - 4.1.2.8 Organic chemistry
  - 4.1.2.9 Measurements in physical science
  - 4.1.2.10 Descriptive chemistry
  - 4.1.2.11 Stoichiometry
  - 4.1.2.12 Thermochemistry
  - 4.1.2.13 Gas laws (including gas stoichiometry)
  - 4.1.2.14 Intermolecular forces, structure and properties of liquids and solids
  - 4.1.2.15 Properties of solutions (including solution stoichiometry)
  - 4.1.2.16 Chemical kinetics
  - 4.1.2.17 Chemical equilibria
    - 4.1.2.17.1 General chemical equilibria
    - 4.1.2.17.2 Acid/base equilibria
    - 4.1.2.17.3 Buffer systems
    - 4.1.2.17.4 Solubility equilibria
  - 4.1.2.18 Chemical thermodynamics
  - 4.1.2.19 Electrochemistry
  - 4.1.2.20 Nuclear chemistry
- 4.1.3 Laboratory experiments for the AP chemistry course
  - 4.1.3.1 Laboratory skills
  - 4.1.3.2 Laboratory notebook
  - 4.1.3.3 Adaptations of the college laboratory experiments
  - 4.1.3.4 Examples of college-level laboratory experiments

- 5.0 Teaching Methodology Information -

5.1 Methods:

Lecture, interactive discussion among seminar participants, and laboratory.

5.2 Student role:

Each student is to participate actively in the seminar by offering the following: teaching techniques and analogies, effective chemical classroom demonstrations and chemical laboratory experiments, examples on how to adapt the college-level course to the constraints of high-school schedules and resources, feedback to other participants, participation in the laboratory experiences.

Each student will write an approximately 20-page paper as a final project on a topic agreed upon by the student and instructor focusing on the application of the content of the Institute to developing the high-school course using a minimum of ten resources from the College Board, chemical instructional literature and chemical education research literature.

- 6.0 Evaluation Information -

6.1 Describe the typical types of student projects that will be the basis for evaluating student performance:

The actual assignments required will be dependent on the experience level of the class as determined by the instructor. Typical assignments may include: Homework sets on chemical content, adaptations of college-level laboratories, construction of appropriate tests and quizzes, active participation in discussions, active participation in laboratories. A high-quality paper of approximately twenty pages is required as a final project. Each teacher's experience and available classroom resources will be crucial in the assignment of the project topic.

6.2 Describe the typical basis for determining the final grade (e.g. weighting of various student projects):

Active participation in the AP Chemistry Institute ~ 50%
Final project ~ 50%

6.3 Grading type:

Letter grades

The approximate grading scale for the course is given as

A Active participation in the AP Chemistry Institute and Final Project that is thorough and creative.
B Active participation in the AP Chemistry Institute and Final Project that meets requirements.
C Mediocre participation in the AP Chemistry Institute and Final Project that meets requirements; or active participation in the AP Chemistry Institute and a submitted Final Project that does not meet expectations.
D Mediocre participation in the AP Chemistry and a submitted Final Project that does not meet expectations.
F Poor participation in the AP Chemistry Institute or no Final Project submitted.

Plus and minus grades can be assigned with instructor discretion to characterize better the quality of work done.

- 7.0 Resource Material Information -

7.1 Textbook(s) or other required readings used in course:

Advanced Placement Program®: Professional Development for Chemistry (The "Acorn" Book) published by the College Board.

7.2 Other student suggested reading materials:

The College Board Advanced Placement website: apcentral.collegeboard.com.

Sally Ann Vonderbrink, **Laboratory Experiments for Advanced Placement Chemistry, 2nd ed**. Flinn Scientific (2005).
John T. Moore and Richard Langley, **5 Steps to a 5 – AP Chemistry**. McGraw-Hill (2004).
George P. Hague and Jane D. Smith, **The Ultimate Chemical Equations Handbook, Teacher ed**. Flinn Scientific (2001).
Bassan Shakhashiri, **Chemical Demonstrations: A Handbook for Teachers of Chemistry, Volume 1 – 4**. University of Wisconsin (1992).

The following journals are among those that can be used to research the final project.

Chemical & Engineering News
Chem 13 News
The Chemical Educator
Journal of Chemical Education
Chemistry Education Research and Practice
Education in Chemistry
Foundations of Chemistry
International Journal of Science Education
National Journal of Science Education
Journal of Science Education and Technology
The Science Teacher

7.3 Current bibliography and other resources:

Theodore L. Brown, H. Eugene LeMay, Jr., Bruce E. Bursten and Catherine Murphy, **Chemistry: The Central Science, 11th ed.** Prentice Hall (2009).
Julia Burdge, **Chemistry**. McGraw-Hill (2009).
Darrell D. Ebbing and Steven D. Gammon, **General Chemistry, 9th ed**. Houghton Mifflin (2009).
John C. Kotz, Paul M. Treichel, and Gabriela C. Weaver, ***Chemistry & Chemical Reactivity, 7th ed***. Brooks/Cole (2009) .
William L. Masterton and Cecile N. Hurley, ***Chemistry: Principles and Reactions, 6th ed***. Brooks/Cole (2009).
Martin Silberberg, ***The Molecular Nature of Matter and Change, 5th ed.*** McGraw-Hill (2009).
James N. Spencer, George M. Bodner and Lyman H. Rickard, ***Chemistry: Structure and Dynamics*, 4th ed**. John Wiley & Sons (2009).
Kenneth W. Whitten, Raymond E. Davis, M. Larry Peck and George G. Stanley, **General Chemistry, 9th ed.** Brooks/Cole (2009).
Raymond Chang, **Chemistry, 9th ed.** McGraw-Hill (2008).
John W. Hill, Ralph H. Petrucci, Terry W. McCreary and Scott S. Perry, **General Chemistry, 5th ed.** Prentice Hall (2008).

John W.Moore, Conrad L. Stanitski and Peter C. Jurs, ***Chemistry: The Molecular Science, 3rd ed***. Brooks/Cole (2008).
John Olmsted III and Gregory M. Williams, **Chemistry, 5rd ed.** John Wiley & Sons (2008).
James E. Brady and Fred Senese, **Chemistry: Matter and its Changes, 5th ed.** John Wiley and Sons (2007).
John McMurry and Robert C. Fay, **Chemistry, 5th ed.** Prentice Hall (2007).
Nivaldo J. Tro, **Chemistry: A Molecular Approach**. Prentice-Hall (2007).
Steven Zumdahl and Susan Zumdahl, ***Chemistry, 7th ed***. Houghton Mifflin (2007).

- 8.0 Other Information -

8.1 Accommodations statement:

8.2 Other:

8.3 Author(s):
Edmund L. Tisko