1. Desired Term: Spring 2008
2a. Course abbreviation and Number: EDST 1005
2b. Abbreviated Title: Chemistry Through Inquiry
3. Type of Instruction: Lecture
5. Billing Units: 0 ($80)
4. Number of Units: 3

6. Allowed Student Levels: UG X GR X EE X (default is to check all three levels)

7. Grading Method: Normal (N) (Default is Letter Grade IV. Students may request Credit/No Credit)
Normal Plus Report-in-Progress (NP) (As for Normal; also allows Report-in-Progress)
Credit/No Credit Only (C)
Credit/No Credit or Report-in-Progress Only (CP)

8. Mode of Instruction:
Type of Instruction | Number of Credit Units | Instructional Mode (Course Classification Number)
--- | --- | ---
Lecture | 3 | C-02
Activity
Lab

9. Attributes: Course Requires Consent for Enrollment? Yes X No
Faculty Credential Analyst Dean Program/Department - Director/Chair
Prerequisites: ____________________ Co-requisites: ____________________

10. Does this course impact other discipline(s)? (If there is any uncertainty as to whether a particular discipline is affected, check "yes" and obtain signature.) Yes X No
If yes, obtain signature(s). Any objections should be stated in writing and attached to this form.
Discipline Signature Date Support Oppose
Discipline Signature Date Support Oppose

Signatures: (College Level)
Kathy Norman 2/4/08
1. Program Director/Chair Date

Important: Please Complete

1. Instructor: Kathy Norman
2. Extension Course Proposal Form (attached)

Signatures: (University Level)
Tom Jones 2/4/08
3. Dean of Extended Studies (or Designee) Date

Kathy Norman 2/26/08
2. College Dean (or Designee) Date

J. Thompson 2/26/08
The President for Academic Affairs (or Designee) Date
Chemistry through Inquiry Syllabus

Faculty Information

Faculty Name: Patricia Galvan

Phone: 202.872.6168

Email Address: p_galvan@acs.org

Course Title: Chemistry through Inquiry

Course Description: During five weeks, students will read science background, do hands-on science investigations, and participate in discussions that focus on the National Science Education content standards for physical science and science as inquiry for K-4 and 5-8. This course of study will enhance students’ science content knowledge and develop an inquiry-based approach to science teaching. Learning activities will comprise approximately 45 hours of student “seat time.”

Course Delivery: Critical to the professional-development experience of teachers today is learning to function effectively in an online learning environment, one that is destined to expand in the future. Chemistry through Inquiry is an online course completed in five weeks, with an additional one-week grace period for submitting assignments. Although students may work on assignments offline, all course content, links to supplementary information, interaction among students in the class, class discussions, assessments, submission of assignments, and interaction with the instructor are carried out online, through email and the course site. This online format is designed for educators who need access to professional development on a flexible schedule and who are in different locations worldwide.

Course Objectives/Outcomes:

Performance Objectives

In this course, students will:
1. Develop an understanding of the National Science Education Standards for scientific inquiry and physical science for elementary and middle school students.
2. Identify and explore developmentally appropriate activities that meet the NSES goals for chemistry-related physical science.
3. Understand the elements of design for inquiry-based physical science activities and demonstrate proficiency in analyzing and conducting guided inquiry activities.
4. Develop strategies to motivate students to ask scientific questions they can investigate. These strategies will guide students to identify and control variables valid to the design of scientific investigations and will promote integration and understanding of scientific inquiry with physical science content.
5. Improve student understanding of fundamental chemistry concepts related to the science activities embedded within the course and identify appropriate targets for various grade level understandings of physical properties and physical change: dissolving solids, liquids, and gases; chemical change; states of matter; and density.
6. Incorporate inquiry experiences into personal responses to physical science lessons and assessments within this course.
Lesson Plans

Topic One: What is Inquiry?
This topic introduces inquiry as defined by the National Science Education Standards and students learn how an activity can be used to generate classroom questions and investigations. The chemistry content describes the polar nature of water and explains the interaction between sucrose and water molecules that causes sugar to dissolve.

Major Ideas:
A. What is Inquiry? Teachers are introduced to the 5 essential elements of inquiry from the NSES.
B. Physical Science Content. Teachers read a summary of the physical science content standards from the NSES for physical science and consider the appropriateness of explanations based on the particulate nature of matter for elementary and middle school students.
C. Inquiring Minds. Inquiry allows for various degrees of guidance from the teacher as directed to more students.
D. Two Standards Are Better Than One. Inquiry content and physical science content should be integrated when teaching science.
E. Extending the Inquiry. Questions at the end of an investigation can be used as assessment and can lead to more open inquiry.
F. Evidence and Explanations. Students develop, evaluate, and justify their explanations.
G. Louis Pasteur's Famous Experiment. The importance of controlling variables in an experiment is described using a historical example.
H. Get Your Feet Wet with Chemistry Content. Since water molecules are polar, water tends to dissolve substances that are also polar and many substances that are made of positive and negative ions.

Hands-on Inquiry Assignments:
1) One M&M. See what happens when 1 M&M is placed in a plate of water.
2) Temperature. Compare the rate the colors dissolve in different temperatures of water.
3) Design and conduct your own investigation about M&M’s in water.

Discussion Assignments:
1) Introduce self and meet classmates.
2) State whether taking course for Graduate Credit, CEU, or Audit.
3) Discuss results and experiences with the hands-on activities.
4) Describe physical science content and inquiry abilities students can develop with the M&M investigation.
5) Take an appropriate quiz.

Topic Two: Identifying Unknowns
This topic investigates physical properties and physical change to discover the identity of an unknown solid and an unknown liquid. Students learn that to identify and control variables to design a fair test is a necessary component of any science investigation; that a performance assessment is an effective way of assessing content knowledge and of understanding scientific inquiry; and that physical properties and physical changes in solids and liquids are based on molecular structure and interactions. The chemistry content identifies whether to use volume or weight to measure equal amounts of crystals; explains the interaction between polar water molecules, sodium ions, and chloride ions that causes salt to dissolve in water; compares the solubility curves for salt and sugar at low and high temperatures; and explains why solubility is a characteristic property.

Major Ideas:

Chemistry Through Inquiry Syllabus 2007
A. Designing Tests – Let’s Be Fair. The characteristic properties of substances can be used to identify unknown substances.

B. Investigating Crystals. If one test does not give enough information to identify an unknown, other tests must be conducted.

C. Dissolving Is the Solution! Solubility is a characteristic property of a substance.

D. There and Back Again. In a physical change the identity of the substance itself is not changed.

E. Flowing Right Along. Students can develop tests to identify and compare characteristic properties of four household liquids.

F. Combining Liquids. Since the household liquids combine with water in characteristic ways, students can identify all 4 unlabeled liquids.

G. Assessing progress. Inquiry activities can be used as performance assessments.

H. Mixin’ It Up with Solutions. Solubility is based on the molecular interaction between the solute and the solvent and is a characteristic property of a substance.

Discussion and Project Assignments:

1) Discuss ways to initiate a science investigation.

2) Discuss results and experiences with the hands-on activities.

3) Take an appropriate quiz.

4) Identify the topic and activity ideas students will develop for the Action Research Project.

Topic Three: Chemical Change

This topic investigates the clues of chemical change and discusses the changes in energy as bonds are broken and formed. The focus is on creating a chemical testing strategy to identify an unknown substance and to understand the significance of the results. The chemistry content explains why some reactions are endothermic and others are exothermic; lists 4 clues of chemical change and identifies 1 example of a physical change that exhibits one of these clues; and considers intermolecular bonds to explain temperature changes during the physical change of dissolving.

Major Ideas:

A. Chemical Tests Make the Grade! Substances react chemically in characteristic and predictable ways.

B. Guiding Students. Students develop a testing procedure to compare a series of chemical reactions.

C. Identify the Unknown. Students use the set of characteristic chemical reactions to identify an unknown powder.

D. Be Endothermic: Be Cool. It takes energy to break the bonds in reactants and energy is released when new bonds are formed in products. If it takes more energy to break the bonds of the reactants than was released when the bonds of the products were formed, the reaction is endothermic.

E. Warm Up to a Reaction. If more energy is released when bonds form than was used to break bonds, a reaction is exothermic.

F. A Precipitate that Will Burst Your Bubble. Substances formed in chemical reactions will have different characteristic properties than the reactants.

G. A Reaction of a Different Color. Students use color changes of red cabbage indicator to compare the amount of acid in two different solutions.

H. Energy Changes—Any Bond Will Do. Intra-molecular bonds connect one atom to another in a molecule and intermolecular bonds attract one molecule to another in a substance.

Hands-on Inquiry Assignments:

1) A cool reaction or a hot reaction. Conduct either an exothermic or endothermic reaction.
2) Control either the amount of product or the temperature change in a chemical reaction.

Discussion Assignments:
1) Suggest ways to teach the distinction between physical change and chemical change to students.
2) Discuss results and experiences with the hands-on activities.
3) Take an appropriate quiz.

**Topic Four: Changing States**
This topic investigates the different states of water and explores how changes in temperature can affect them. Teachers design tests to investigate the effect of heat energy on changes of state; the resulting transfer of energy; and the changes in intermolecular bonds. Chemistry content describes differences in solids, liquids, and gases in terms of intermolecular attractions and energy; explains what causes a drink to get cold when it is placed in a refrigerator; uses the terms “temperature”, “evaporation”, and “condensation” to explain the state changes that occur in (and out of) a steaming teapot; and explains the flat line on phase change diagrams for boiling and freezing water.

**Major Ideas:**
A. Expanding Possibilities. Molecules move faster when they are warmed and slower when they are cooled.
B. Does the State Matter? A combination of the attractive forces between molecules and their kinetic energy determines whether a substance is a solid, liquid, or gas. The difference between heat and temperature is explained.
C. Evaporation Exploration. After an evaporation demonstration, students can help design an experiment to see if adding heat increases the rate of evaporation.
D. Concentrate on Condensation. Students observe the process of condensation and help design an experiment to see if removing heat increases the rate of condensation.
E. A Moisture Mystery. Students can identify and create the conditions necessary to produce moisture on the outside of a cold container. There are many common examples of condensation.
F. Condensation for the Humidity-Challenged. Water vapor in the air condenses when it is cooled.
G. Frosty the Snowman. When a container is cold enough, water vapor in the air condenses to a liquid and then freezes to ice.
H. State Your Case. When heat energy is added to or removed from a substance, intermolecular bonds break or form. These changes in the intermolecular associations cause matter to change from one state to another.

**Hands-on Inquiry Assignments:**
1) *Expanding possibilities* and a gas Bubble-o-meter. Warm and cool the gas inside a bottle to see a lid tap and a bubble grow and shrink.
2) *Evaporation exploration* or *Concentrate on condensation*. Heating water increases the rate of evaporation and cooling water increases the rate of condensation.
3) Investigate the cause of moisture on the outside of a cold drink.

**Discussion and Project Assignments:**
1) Suggest ways to teach states of matter and offer developmentally appropriate explanations to students.
2) Discuss molecular explanations for everyday examples of evaporation, condensation, melting, and freezing of water.
3) Discuss results and experiences with the hands-on activities.
4) Take an appropriate quiz.
5) Submit an outline of the Action Research Project.

Chemistry Through Inquiry Syllabus 2007
Topic Five: Understanding Density
This topic explores the concept of density through the context of sinking and floating and identifies density as a characteristic property of a substance. Chemistry content considers volume, mass, and density to explain why a lifejacket works; explains why a carrot that sinks in fresh water can float in salty water; and describes the relative distance between molecules in hot water, cold water, and ice.

Major Ideas:
A. Floating the Concept of Density. There is more to floating and sinking than being light or heavy.
B. Predicting Floaters and Sickers. Density is a characteristic property of a substance and can be defined as the mass of an object divided by its volume.
C. Liquid Layers. Liquids have different densities and may sink or float in water.
D. Temperature Tower. Hot water is less dense than cold water.
E. Changing a Liquid's Density. An object may sink in fresh water yet float in saltwater because saltwater is denser than fresh water.
F. Whatever Floats Your Boat. The weight of the fluid displaced by a floating object equals the weight of the object.
G. Density is Uncanny. Life preservers work by adding volume without much mass.
H. All about Density. An increase in mass will increase the density of an object while an increase in volume will decrease its density.

Hands-on Inquiry Assignments:
1) Hovering carrot or Temperature tower. Explore the effect of density differences in water on sinking and floating.
2) Design a "flotation device" for a can of soda pop or some other object that ordinarily sinks.

Discussion and Project Assignments:
1) Discuss examples of density in life science, earth and space science, technology, and mathematics.
2) Discuss results and experiences with the hands-on activities.
3) Submit the Action Research Project.
4) Complete JASON Course survey.

Texts (required readings): Course Content found in Blackboard

Bibliography (required and optional readings): External on-line readings and interactive web-based activities are identified within the on-line documents of this course. Web-addresses often change; hence the best locator for this material is through the on-line course.

Student Evaluation Process:

Students are assessed through a series of on-line discussions on hands-on projects and inquiry activities; topic quizzes; and a final project. Not all students seek college credit; some earn CEUs or audit. Students earning college credit are required to participate in advanced discussions and complete all assignments. Students taking the course for 3 graduate credits will design a 10-15 page Action Research project that includes a set of at least 3 lessons that integrate both inquiry and physical science learning and build upon one another to fully develop a concept. These lesson plans should include questions to
investigate, materials lists, procedures, questions to guide the discussion, student activity sheets, and an assessment.

Students may earn 40 points through discussions and inquiry activities, 40 points on quizzes, and 20 points on the final project. During the first week of the course students must declare the nature of the credit sought – Graduate, CEUs, or Audit. During the final week of the course students must complete the JASON Course Survey.

* Students not taking the course for graduate credit do not have to complete the Research Paper and must obtain at least 70 points to pass the course

* Students taking the course for graduate credit will be graded according to the Plus/Minus Grading Scale:

- A+ 97-100
- A 94 - 96.99
- A- 90 - 93.99
- B+ 87 - 89.99
- B 84 - 86.99
- B- 80 - 83.99
- C+ 77 - 79.99
- C 74 - 76.99
- C- 70 - 73.99
- D 50 - 69.99
- F 50+
Patti Galvan
1916 Griffith Road
Falls Church VA 22043
703-356-5793
p_galvan@acs.org

Work Experience
1999-present  American Chemical Society
                Washington DC
Develop and publish inquiry-based physical science activities for grades K-8 in
print and on the web. Conduct teacher professional development workshops for
teachers in grades 3-8 both in-person and online.

1994-1999  Immaculate Conception School
            Columbus Ohio
Taught second grade and fifth grade reading, language arts, math, science, art,
and health. Served on committee to select textbooks for math and science.
Developed many science activities and units.

1994 & 1995  Columbus Metropolitan Library
Presented classes for children in the Summer Reading Program. Read books
aloud, presented puppet shows, and facilitated crafts.

1993-1994  Columbus, Grandview, Upper Arlington, Diocese
Substitute taught elementary, middle, and high school in 4 area school districts

1992-1993  COSI Science Museum
Researched, wrote, and presented full day workshops on Bionics and
Transplants for elementary and middle school students all over Ohio. Organized
each event and trained parent volunteers to lead hands-on activity tables.

1991-1992  Eastside Childcare Center
Taught Kindergarten in urban childcare setting. Developed own program
because materials were scarce.

1991  The Ohio State University
Taught Spatial Visualization and was a TA for Topology math courses for the
Young Scholars Program which provided advanced course work during the
summer for gifted minority students.

Education
1987-1990  The Ohio State University
BS Elementary Education
Columbus, Ohio
1985-1987  Armstrong Atlantic State University
Transferred
Savannah, Georgia
James H. Kessler
904 Lanark Way
Silver Spring, Maryland, 20901
202-872-6165
j_Kessler@acs.org

Work Experience:
1989-present
American Chemical Society, Manager, Office of K-8 Science
Develop, write, and publish inquiry-based physical science activities for grades K-8 and
teacher professional development materials in print and on the web. Wrote WonderScience
magazine, featuring physical science activities from 1989-2000. Co-wrote Inquiry in Action-
their science background while providing inquiry-based activities to do with students. Co-
wrote Chemistry through Inquiry, a 5-week online chemistry course for elementary and
middle school teachers. Conduct in-person teacher professional development workshops to
help elementary and middle-school teachers incorporate more inquiry-based physical science
into their teaching.

1988-1989
High school science teacher, Largo High School, Prince George’s County Maryland.
Taught 9th grade Biology. Developed lessons and labs for freshman biology with an emphasis
on life processes on the molecular level.

1986-1988
High school science teacher, Escola Graduada de Sao Paulo, Sao Paulo, Brazil.
Taught 9th grade Biology, 11th grade Physical Science, and co-taught Theory of Knowledge
in the International Baccalaureate program.

1982-1986
Association of Trial Lawyers of America (ATLA), Washington, DC
Associate editor for the ATLA Law Reporter
Wrote articles reviewing case law and appellate decisions in the developing area of products
liability law.

Education:
1983-1985
University of Maryland, College of Education, College Park, MD
BS Science Education, 1985

1979-1982
Boston University School of Law, Boston MA
JD, 1982

1974-1978
Columbia University, New York, NY
BA Philosophy, 1978
Virginia Mann

From: Jacqueline Trischman
Sent: Friday, February 22, 2008 4:00 PM
To: Virginia Mann
Cc: David Barsky; Catherine BoyleAsker
Subject: RE: Chem-related courses from Extended Learning

The only one I can really review is the Chemistry Through Inquiry course. I could send out the others to other faculty for review, but I know what they would say already - It is difficult to judge the quality of the course with no access to the required readings and no required textbook. The way these courses are taught, it is easy to do a poor job and very difficult to teach them well. I would have to know more about the instructors to really assess the course in a meaningful way. I know the instructors in the Chemistry Through Inquiry course are working for the ACS, and I trust they have excellent quality control, but just looking at the resume's of the faculty is not exactly inspiring as far as knowing content. One instructor has a bachelor's in elementary education and the other has a bachelors in biology (science ed, but all experience was in biology).

The syllabi are explicit about the topics, and their coverage is appropriate for such courses. I simply cannot go any further in my statements given the information we have about the courses and their instructors.

jackie

From: Virginia Mann
Sent: Friday, February 22, 2008 2:46 PM
To: Jacqueline Trischman
Cc: David Barsky; Catherine BoyleAsker
Subject: Chem-related courses from Extended Learning

Hello Jackie,

David has reviewed the attached courses that Extended Learning would like to offer for non-degree extension credit, and would appreciate if you would review them also. Please let us know if you have any comments or concerns.

Thanks so much,
Virginia

Virginia Peters Mann
Curriculum Specialist
Academic Programs
CSU San Marcos
Tel: (760) 750-8887