Curriculum Proposal Cover Sheet – **form is available on-line as an interactive PDF**

LSC Use Only Proposal No:	*UWUCC Use Only* Proposal No: 14-29a. 13-202a
LSC Action-Date: AP-9/4/14	UWUCC Action-Date: AP-9/23/14 Senate Action Date: App 10/7/14

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

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Proposing Department/Unit Chemistry	Phone 7-4489

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

_____ New Course _____ Course Prefix Change _____ Course Deletion

__x__ Course Revision _____ Course Number and/or Title Change __x__ Catalog Description Change

Current course prefix, number and full title: SCI 102 Fundamentals of Chemistry
Proposed course prefix, number and full title, if changing: NA

2. Liberal Studies Course Designations, as appropriate

__X__ This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

_____ Learning Skills __X__ Knowledge Area _____ Global and Multicultural Awareness _____ Writing Intensive (include W cover sheet)

_____ Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)

_____ Global Citizenship _____ Information Literacy _____ Oral Communication

_____ Quantitative Reasoning _____ Scientific Literacy _____ Technological Literacy

3. Other Designations, as appropriate

_____ Honors College Course _____ Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

_____ Catalog Description Change _____ Program Revision _____ Program Title Change _____ New Track

_____ New Degree Program _____ New Minor Program _____ Liberal Studies Requirement Changes _____ Other

Current program name:

Proposed program name, if changing:

5. Approvals	**Signature**	**Date**
Department Curriculum Committee Chair(s)	Ronald See	3/4/14
Department Chairperson(s)	Dan Young	3/4/14
College Curriculum Committee Chair	Anne Kondo	3/28/14
College Dean	Diane Lantz	4/1/14
Director of Liberal Studies (as needed)	Daniel H Reilly	9/17/14
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate	Edel Reilly TECC Anna Smithhisler	4/18/14
UWUCC Co-Chairs	Gail Sechrist	9/24/14

Received SEP 24 2014 Liberal Studies

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Part II: Description of Curriculum Change
1. SYLLABUS OF RECORD

I. Catalog Description

SCI 102 Fundamentals of Chemistry **2c-2l-2.5cr**
Prerequisite: Early Childhood/Special Education major or instructor permission

This chemistry course for pre-service early childhood/special education majors is a survey of chemical principles and concepts. A variety of chemical concepts will be presented, as well as their applications to technology and society. A series of laboratory exercises and projects will allow student to develop inquiry-based activities for the communication of scientific and chemical concepts, with the goal of developing scientific literacy.

II. A. Course Outcomes
At the conclusion of this course, students should be able to:

Objective 1
Summarize the following concepts: science, technology, scientific fact, scientific theory, scientific law, and hypothesis.

Expected Student Learning Outcomes 1 and 2
Informed and Empowered Learners
Rationale
Students will learn the foundations of science, and how to apply these to a variety of everyday scientific phenomena. Students will also consider how to express these concepts in the elementary education classroom.

Objective 2
Discuss the role of chemistry in describing natural phenomena, and how chemical principles and concepts relate to everyday living.

Expected Student Learning Outcomes 1 and 2
Informed and Empowered Learners
Rationale
Students will evaluate how chemistry-specific principles inform our understanding of many real-world systems, and how to convey these ideas to elementary-level students.

Objective 3
Describe essential concepts of chemistry.

Expected Student Learning Outcome 1
Informed Learners
Rationale
Students will gain a knowledge base in following the concepts of chemistry: energy and changes in matter; atomic structure; Periodic Table of the Elements; chemical bonding and its importance to everyday living; solutions, especially the dissolving process and concentration; acid-base chemistry and its importance to everyday living; nuclear chemistry and its importance to society and technology.

Objective 4

Explain the way that science, and specifically chemistry, is done.

Expected Student Learning Outcomes 1, 2 and 3

Informed, Empowered and Responsible Learners

Rationale:

Students will gain an understanding of the habits of mind that underlie the scientific process: observing, classifying, inferring, predicting, measuring, communicating, formulating hypotheses, experimenting, and collecting and interpreting data. Students will also discuss the history of chemistry; the men, women, and minorities responsible for the contributions.

Objective 5

Communicate the concepts of science and chemistry to both children and adults.

Expected Student Learning Outcomes 2 and 3

Empowered and Responsible Learners

Rationale:

Students will develop both presentations and activities that explain the concepts of science in an easily-understood manner. All education professionals have a responsibility to help alleviate the rampant scientific illiteracy in our culture. The activities will stress active participation and chemical safety.

II. B. Student Outcomes Assessment Matrix

Course Objectives	NSTA Program Objectives	Danielson Domains	Assessment Technique
1	1 (a, b)	I, II	Lab Investigations, **Exam 1***
2	1 (a, b)	I, II, III	Lab Investigations, **Exam 1***
3	1 (a, b)	I, II	Lab Investigations, **Exam 2, 3***
4	1 (a, b)	I, II, IIII	Lab Investigations, **Exam 2, 3***
5	3 (a, d)	I, II, III	Lab Investigations, written work

***Exams 1 and 3 will be used as Key Assessments for this course.**

III. Course Outline

Lecture Outline – allow 2 class periods for exams, plus exam during 2-hour culminating activity period

1.	Science versus Technology Science, technology, scientific fact, scientific theory, scientific law, scientific truth versus absolute truth.	3 lectures
2.	Measurement Precision, accuracy, metric system, scientific notation, conversions using dimensional analysis.	3 lectures
3.	Chemistry: The Study of Matter Matter and energy, states of matter (solid, liquid, gas), changes of state, classification of matter (pure substances and mixtures, elements and compounds), chemical and physical changes.	2 lectures
4.	The Development of the Idea of Atoms Law of Conservation of Mass, Law of Definite Proportions,	2 lectures

	Law of Multiple Proportions, Dalton's Atomic Theory of Matter, Periodic Law, Modern Periodic Table	
5.	Exam #1	1 lecture
6.	Models for the Atom: Atomic Structure Plum Pudding Model, Nuclear Atom, Bohr Atom, Modern Atom and Quantum Theory	2 lectures
7.	Chemical Bonding Ionic bonding, covalent bonding, polyatomic ions, writing chemical formulas, nomenclature of ionic and covalent compounds, chemical equations, shapes of molecules, polarity of molecules.	4 lectures
8.	Solutions Solvents, solutes, and solutions; intermolecular forces of attraction; the dissolving process; water and water as a solvent; predicting solubility; percent concentration, mole, molarity.	4 lectures
9.	Exam #2	1 lecture
10.	Acids, Bases, and Chemical Equilibrium Definitions of acids and bases, ionization, dissociation, neutralization, chemical equilibrium and Le Chatelier's Principle, strength of acids and bases in relation to environmental problems and consumer products, pH.	4 lectures
11.	Nuclear Chemistry Atomic nuclei and nuclear symbols, nuclear emissions, nuclear reactions, half life, biological effects of radiation, sources of radiation exposure, nuclear medicine, nuclear fission versus nuclear fusion reactions, major differences between nuclear and chemical reactions.	2 lectures
12.	Final Exam	Final exam period

Laboratory Outline – allow 1 lab period for each activity

1.	Laboratory safety, indirect observation
2.	Measuring in the metric system
3.	Density and the experimental determination of grams of sugar in a solution
4.	Direct observations: Physical and chemical changes
5.	Separation of mixtures using paper chromatography

6.	Identification of a chemical unknown using chemical and physical tests.
7.	Ionic compounds: Bonding, chemical formulas and nomenclature
8.	Covalent compounds: Bonding, chemical formulas and nomenclature
9.	Solubility Problem: Design and conduct an experiment to solve a problem
10.	pH, cabbage juice and the strength of household acids and bases
11.	Science communication activities: hands-on, inquiry-based, student centered (individual or partner presentations)
12.	Science communication activities: hands-on, inquiry-based, student centered (individual or partner presentations)
13.	Science communication activities: hands-on, inquiry-based, student centered (individual or partner presentations)
14.	Clean-up, check out

IV. Evaluation Methods

The final grade for the course is determined as follows:

60%	Exams	2 - 50 minute exams during semester, one during final exam week.
15%	Written Work	Four written reports summarizing hands-on, inquiry-based science communication activities. Students are required to read professional journals, books, or search the Internet to find suitable activities.
25%	Lab	Lab reports, quizzes, teaching lesson and written report of the teaching lesson. The lab percent grade is reported to the lecture instructor who has the option of normalizing lab grades. Students must pass lab with a 70% or better to pass the course.

V. Example Grading Scale

The final grade for this course will be determined using the following schedule:

A=90-100%; B=80-89%, C=70-79%, D=60-69%, F=<60%

VI. Attendance Policy

The attendance policy will conform to IUP's undergraduate course attendance policy, as outlined in the Undergraduate Catalog.

VII. Required textbooks, supplemental books and readings

Texts: Suchocki, John (2013). Conceptual Chemistry. Prentice Hall (Chemistry Department self-published laboratory packet)

Supplemental readings:
Journals: *Journal of Chemical Education, Science and Children, Dragonfly*

VIII. Special resource requirements
There are no special resource requirements for this course.

IX. Bibliography
In addition to the required textbooks and supplemental readings from science journals, the following will be used to develop the course curriculum:

Ansberry, Karen and Emily Morgan, 2007, More Picture-Perfect Science Lessons: Using Children's Books to Guide Inquiry, K-4: NSTA Press, Arlington, VA.

Ansberry, Karen and Emily Morgan, 2010, Picture-Perfect Science Lessons, Expanded 2nd Edition: Using Children's Books to Guide Inquiry, 3-6: NSTA Press, Arlington, VA.

Ansberry, Karen and Emily Morgan, 2013, Even More Picture-Perfect Science Lessons: Using Children's Books to Guide Inquiry, K–5: NSTA Press, Arlington, VA.

Bennett, A. T.; Kessler, J. H. *Apples, Bubbles, And Crystals*; Learning Triangle Press: Middletown, OH, 1996.

Bennett, A. T.; Kessler, J. H. *Sunlight, Skyscrapers, and Soda Pop*; Learning Triangle Press: Middletown, OH, 1997.

Carson, Rachel, 1965. Silent Spring: Houghton Mifflin.

Van Cleave, J. P. *Chemistry for Every Kid: 101 Easy Experiments that Really Work*; John Wiley & Sons, Inc.: New York, 1989.

Sarquis, J. L.; Sarquis, M.; Williams, J. P. *Teaching Chemistry With Toys*; Learning Triangle Press: Middletown, OH, 1995.

VanCleave, J.P. *200 Gooey, Slippery, Slimy, Weird & Fun Experiments*; John Wiley & Sons, Inc.: New York, 1992.

VanCleave, J.P. *201 Awesome, Magical, Bizarre & Incredible Experiments*; John Wiley & Sons, Inc.: New York, 1994.

VanCleave, J.P. *202 Oozing, Bubbling, Dripping & Bouncing Experiments*; John Wiley & Sons, Inc.: New York, 1996.

2. SUMMARY OF PROPOSED REVISIONS

1. Pre-requisite courses changed to better meet the needs of ECSP students in their new curriculum and to allow more flexibility in taking their science courses.

2. Updated the course description to better reflect the nature of this class.

3. Objectives – course objectives were modified from the most recent syllabus of record and aligned with the Expected Undergraduate Student Learning Outcomes (EUSLO).

4. Common Learning Objectives for a Laboratory Natural Science course were incorporated into the content of the course. These objectives include: understand a body of knowledge in a science domain; understand that science knowledge is generated by an empirical approach to nature and analyze problems from the perspective of a natural scientist; demonstrate an understanding of intellectual honesty in the context of scientific methodology, and contrast science with pseudoscience; understand how science knowledge is relevant to non-scientists and use critical thinking skills and scientific methodology.

5. Updated text to a more current book and updated the bibliography to reflect current resources used to develop this course.

3. JUSTIFICATION/RATIONALE FOR REVISIONS

The course is currently approved for Liberal Studies Laboratory Natural Science (in conjunction with two additional companion courses selected from SCI 101, 103 and 104). This sequence of three 2.5 credit courses only satisfies the Liberal Studies requirement for ECSP students. Changes in the Liberal Studies curriculum and in the ECSP program demanded that this course be adjusted to meet new needs and expectations.

4. OLD SYLLABUS OF RECORD

CATALOG DESCRIPTION

COURSE NUMBER	SCI 102
COURSE TITLE:	Fundamentals of Chemistry
NUMBER OF CREDITS:	2.5 cr (2c-2l-2.5 sh)
PREQUISITES:	Elementary Education major or Instructor Permission
COURSE DESCRIPTION:	A survey of chemical principles and concepts. The nature of chemical reactions as applied to technology and its applications to society. The world of consumer chemistry will be explored. The goal is to develop a chemical literacy for the students. A series of laboratory exercises develops concept understanding and process skills. Some individual and group projects will be included. This course does not fulfill the Liberal Studies requirement except for majors in

	Elementary and Early Childhood Education.

II. COURSE OBJECTIVES

This course is aligned with state and national standards (Pennsylvania Chapter 4 Academic Standards for Science and Technology, Pennsylvania Chapter 354 Standards for Chemistry Teacher Preparation, NSTA Standards for Science Teacher Preparation) and is designed so that the student will:

- Distinguish between science and technology. **[Ch. 4: 3.2.4.A, 3.2.7.A, 3.2.10.A. NSTA: 2a, 2b]**
- Distinguish among scientific fact, scientific theory, scientific law, and hypothesis. **[Ch. 4: 3.2.4.A, 3.2.7.A, 3.2.10.A. NSTA: 2a, 2b]**
- Develop an understanding of the role of chemistry in describing natural phenomena. **[Ch. 4: 3.4.4.A, 3.4.7.A, 3.4.10.A, 3.4.12.A. NSTA: 1a, 1b, 2a]**
- Develop an understanding of chemical principles and concepts and how they relate to everyday living. **[Ch. 4: 3.4.4.A, 3.4.7.A, 3.4.10.A, 3.4.12.A. Ch. 354: IB. NSTA: 1a, 1b, 4c]**
- Be able to explain in chemical terms, the classification of matter and changes of matter. **[Ch. 4: 3.4.4.A, 3.4.7.A, 3.4.10.A. Ch. 354: ID. NSTA: 1a, 1b]**
- Develop an understanding of the relationship between energy and changes in matter. **[Ch. 4: 3.1.4.B, 3.4.7.B. NSTA: 1a, 1b]**
- Develop an understanding of atomic structure. **[Ch. 4: 3.4.10.A. Ch. 354: IC. NSTA: 1a, 1b]**
- Develop an understanding of, and be able to use, the Periodic Table of the Elements. **[Ch. 4: 3.1.10.C, 3.4.10.A. Ch. 354: IC. NSTA: 1a]**
- Develop an understanding of chemical bonding and its importance to everyday living. **[Ch. 4: 3.4.4.A, 3.4.7.A, 3.4.10.A. Ch. 354: IB, IC. NSTA: 1a, 4c]**
- Develop an understanding of solutions, especially the dissolving process and concentration. **[Ch. 4: 3.4.4.A. Ch. 354: ID. NSTA: 1a]**
- Develop an understanding of acid-base chemistry and its importance to everyday living. **[Ch. 4: 3.4.12.A. Ch. 354: IB. NSTA: 1a, 4c]**
- Develop an understanding of nuclear chemistry and its importance to

society and technology. **[Ch. 4: 3.4.12.A. Ch. 354: IB. NSTA: 1a, 4c]**

- Develop skills in the process of science: observing, classifying, inferring, predicting, measuring, communicating, formulating hypotheses, experimenting, and collecting and interpreting data. **[Ch. 4: 3.1.4.D, 3.1.7.D, 3.1.10.D, 3.1.12.D, 3.2.4.A, B, C, D; 3.2.7.A, B, C, D; 3.2.10.A, B, C, D; 3.2.12.A, B, C, D. Ch. 354: IA, IH. NSTA: 3a, 3b]**

- Develop an appreciation for the history of chemistry; the men, women, and minorities responsible for the contributions. **[Ch. 354: II]**

- Develop critical thinking and problem solving skills. **[Ch. 4: 3.2.4.B, C, D; 3.2.7.B, C, D; 3.2.10.B, C, D; 3.2.12.B, C, D. Ch. 354: IH. NSTA: 3a, 3b]**

- Develop strategies for teaching chemistry to elementary school children. **[Ch. 354: IIA, IIB, IIC. NSTA: 5a, 5b, 5c, 9b]**

III. DETAILED COURSE OUTLINE

Fundamentals of Chemistry is a multi-section course taught by a team of instructors. However, it is coordinated so that the students experience the same series of lecture topics and the same laboratory activities.

A. Lecture Topics

1.	Science versus Technology Science, technology, scientific fact, scientific theory, scientific law, scientific truth versus absolute truth.	1 lecture
2.	Measurement Precision, accuracy, metric system, scientific notation, conversions using dimensional analysis.	3 lectures
3.	Chemistry: The Study of Matter Matter and energy, states of matter (solid, liquid, gas), changes of state, classification of matter (pure substances and mixtures, elements and compounds), chemical and physical changes.	3 lectures
4.	The Development of the Idea of Atoms Law of Conservation of Mass, Law of Definite Proportions, Law of Multiple Proportions, Dalton's Atomic Theory of Matter, Periodic Law, Modern Periodic Table	2 lectures

5.	Models for the Atom: Atomic Structure Plum Pudding Model, Nuclear Atom, Bohr Atom, Modern Atom and Quantum Theory	2 lectures
6	Chemical Bonding Ionic bonding, covalent bonding, polyatomic ions, writing chemical formulas, nomenclature of ionic and covalent compounds, chemical equations, shapes of molecules, polarity of molecules.	6 lectures
7.	Solutions Solvents, solutes, and solutions; intermolecular forces of attraction; the dissolving process; water and water as a solvent; predicting solubility; percent concentration, mole, molarity.	4 lectures
8.	Acids, Bases, and Chemical Equilibrium Definitions of acids and bases, ionization, dissociation, neutralization, chemical equilibrium and Le Chatelier's Principle, strength of acids and bases in relation to environmental problems and consumer products, pH.	2 lectures
9.	Nuclear Chemistry Atomic nuclei and nuclear symbols, nuclear emissions, nuclear reactions, half life, biological effects of radiation, sources of radiation exposure, nuclear medicine, nuclear fission versus nuclear fusion reactions, major differences between nuclear and chemical reactions.	2 lectures

B. Laboratory Topics – 1 Laboratory Period for each Activity

1.	Laboratory safety, indirect observation
2.	Measuring in the metric system
3.	Density and the experimental determination of grams of sugar in a solution
4.	Direct observations: Physical and chemical changes
5.	Separation of mixtures using paper chromatography
6.	Identification of a chemical unknown using chemical and physical tests.
7.	Ionic compounds: Bonding, chemical formulas and

	nomenclature
8.	Covalent compounds: Bonding, chemical formulas and nomenclature
9.	Solubility Problem: Design and conduct an experiment to solve a problem
10.	pH, cabbage juice and the strength of household acids and bases
11.	Student teaching lessons: hands-on, inquiry-based, student centered (individual or partner presentations)
12.	Student teaching lessons: hands-on, inquiry-based, student centered (individual or partner presentations)
13.	Student teaching lessons: hands-on, inquiry-based, student centered (individual or partner presentations)

IV. EVALUATION METHODS

The final grade for the course is determined as follows:

70%	Exams	Quizzes and/or one-hour tests, cumulative final.
5%	Written Work	Four written reports summarizing hands-on, inquiry-based chemistry activities for elementary students. Students are required to read professional journals, books, or search the Internet to find suitable activities.
25%	Lab	Lab reports, quizzes, teaching lesson and written report of the teaching lesson. The lab percent grade is reported to the lecture instructor who has the option of normalizing lab grades. Students must pass lab with a 70% or better to pass the course.

V. REQUIRED TEXTBOOK(S)

Stoker, H. Stephen. *Introduction to Chemical Principles,* 7th Ed.; Prentice Hall: Upper Saddle River, NJ, 2002.

Eddy, R.; Fazio, F.; Ballas, F. *SCI 102 Fundamentals of Chemistry* lab manual. (Obtain at Pro-Packet.)

The laboratory portion of this course is designed to provide the students with hands-on experience with the chemical principles discussed in lecture as well as to provide the students with standards-based activities that they can use in their classrooms.

VI. SPECIAL RESOURCE REQUIREMENTS

Students are required to have their own calculator that adds, subtracts, multiplies, divides, and does logs.

This course is identified as a high-risk course (30% or higher rate of D/F/W's) and as such has Supplemental Instruction (SI). Trained SI student leaders attend class sessions and then provide out-of-class sessions in which they assist students on how to learn course content. SCI 102 students are strongly encouraged to attend the SI sessions.

VII. BIBLIOGRAPHY

Possible resources for hands-on, inquiry-based chemistry activities and sources of the standards are:

Books:

Van Cleave, J. P. *Chemistry for Every Kid: 101 Easy Experiments that Really Work*; John Wiley & Sons, Inc.: New York, 1989.

VanCleave, J.P. *200 Gooey, Slippery, Slimy, Weird & Fun Experiments*; John Wiley & Sons, Inc.: New York, 1992.

VanCleave, J.P. *201 Awesome, Magical, Bizarre & Incredible Experiments*; John Wiley & Sons, Inc.: New York, 1994.

VanCleave, J.P. *202 Oozing, Bubbling, Dripping & Bouncing Experiments*; John Wiley & Sons, Inc.: New York, 1996.

Sarquis, J. L.; Sarquis, M.; Williams, J. P. *Teaching Chemistry With Toys*; Learning Triangle Press: Middletown, OH, 1995.

Bennett, A. T.; Kessler, J. H. *Apples, Bubbles, And Crystals*; Learning Triangle Press: Middletown, OH, 1996.

Bennett, A. T.; Kessler, J. H. *Sunlight, Skyscrapers, and Soda Pop*; Learning Triangle Press: Middletown, OH, 1997.

Journals:

Journal of Chemical Education
Science and Children

Dragonfly

Internet:

http://chemistry.org/portal/Chemistry?PID=wondernetdisplay.html&DOC=wondernet%5Cbestof%5Cbestof.html (American Chemical Society's WonderScience)

Standards:

National Research Council. *National Science Education Standards.* National Academy Press: Washington, DC, 1996.

National Science Teachers Association. *Standards for Science Teacher Preparation,* 1998. [On-line]. Available: http://www.nsta.org/main/pdfs/nsta98standards.pdf

Pennsylvania Department of Education. *Academic Standards For Science and Technology*, 2002. [On-line]. Available: http://www.pde.state.pa.us/k12/lib/k12/scitech.doc

Pennsylvania Department of Education. *Chapter 354*, Pennsylvania Bulletin, 30, 2002, 30-41. [On-line]. Available: http://www.pabulletin.com/secure/data/vol30/30-41/1719.html

Syllabus updated on	April 6, 2002

Assignment Instructions for a major course assignment

Chemistry Research project

During the next three weeks you will be performing, and reporting on an original experiment, related to one of the 6 topics provided below. You will be provided with equipment that will allow you to measure mass, volume, time, and temperature. Using this equipment, along with other things available in lab, your group must design an experiment that will explore some feature of the topic provided. The results of the experiment will be reported during class with a poster presentation.

1. Choosing the topic.

The research groups will consist of four or fewer students seated at the same lab table. Each group will have a unique topic, the order of selection will be drawn at random. The available topics are

1. The baking soda and vinegar reaction
2. The properties of water
3. The burning candle
4. Analysis of Mixtures
5. Making crystals
6. Diffusion and Brownian motion.

2. Researching the topic

Before coming to lab, you must do some research to find out about your topic. Some general information about each topic is provided at the end of this section, however, you must also find some details on your own. Perhaps websites on science fair projects, or in class demonstrations would be useful.

3. Designing the experiment.

The first step in designing an experiment is deciding on the specific chemical relationship to measure. For example, perhaps a group would choose to study the relationship of density and temperature. Their hypothesis might be that density decreases with temperature. To show this , they would have to measure the density (mass and volume) at several different temperatures. They would also need to measure the temperature, and change the temperature. They might use a hot plate to warm water to different temperatures, and then measure its volume and mass. But how would they do this without having to worry about the water cooling down ? As you see the design will require some thought. Discussion with your group members and instructor is essential here.

4. Performing the experiment.

Once you have a design, and the design has been approved by the instructor, you will want to collect the materials to perform the experiment, and then try some preliminary experiments. Your first experiments may not be completely successful, so expect to do a number of trials before you are successful. Be sure to record observations, and all of your data. These records should be complete as possible, even if the experiment does not work.

5. Reporting the results.

Group Poster presentation. After you have completed the experiment, you must report your results to the class. To do this, your group will prepare a poster. The easiest way to construct a poster is to prepare a number of 8 ½ x 11 powerpoint slides, and attach them to a cardboard poster board. The poster will consist of the following slides

1. Title, including the names of everyone in the group.
2. Research question and hypothesis
3. Introduction – Several bullet points about the background of the chemical principle being studied, why it is important, and justification for your hypothesis (may be more than 1 slide)
4. Experimental methods – describe your experiment. This would include diagrams, pictures, etc. (can be more than 1 slide)
5. Results – Tables and Graphs that clearly show your results. (probably more than 1 slide)
6. Conclusion – was you hypothesis correct ? why or why not ? What is your new hypothesis in light of your results ?

Individual report. – Each member of the group will prepare a 2 page paper documenting their experience with the research project.

The paper should answer the following questions:

- Briefly describe the project
- Why did your group choose the specific project ?
- Do you think that the project was successful ?
- Describe the workload for each member of the group.
- What further experiments might you have done to make the project better.

Research project worksheet

(Turn this in, counts as a lab report)

Name: Research topic:	Group member: Group member: Group member:
List references to 3 outside resources you found regarding the topic. These can be websites, books articles, etc.	1. 2. 3.
Write the hypothesis you will be testing	

Check the experimental design with your instructor, you must have your instructors signature to begin the experiment.	Instructor's signature.
List the materials needed for your experiment	1. 2. 3. 4. 5.

Topics

Baking soda and vinegar. – This is a classic chemical reaction performed as a demonstration for elementary students. As a project, students can look at several aspects of this reaction in detail. For example, what is the relationship between the amounts of materials, and the amount of CO_2 produced ? What causes the reaction to proceed faster or slower ? What temperature change occurs during the reaction ? What factors effect this (amount of material, how fast the reaction occurs)

Properties of water. –There are several important properties of water, surface tension, specific heat, heat of vaporization, ability to dissolve material. As a project, students might evaluate ways of measuring surface tension of various substances, determine the specific heat, or show how much energy it takes for water to evaporate to list a few examples. This project has many possibilities.

The Burning Candle. –There is a lot of interesting chemistry in a candle. Students might evaluate the relationship between the time burned and the weight of the candle. They may examine the effect of limiting the oxygen available, and determine the relationship between amount of oxygen and burning time.

Mixtures – How does mixing two substances change their properties. For instance, how does mixing salt and water change the density of the solution ? How can we separate mixtures ? Can we determine the components of a mixture ? What effects this ability ?

Making Crystals. – How are crystals formed, and what can we do to form them. What conditions have an effect on the type of crystals formed ? What substances for the most interesting crystals.

Diffusion and Brownian Motion. How do molecules move, and how do we know. Students might study how fast different material diffuse through a liquid, or through a gas. They may study the relationship between temperature and diffusion, or the polarity of a substance and diffusion.

LAB PRESENTATION EVALUATION FORM

SCI 102 Fall 2013 Dr. Chinn

Names: _____

Title: _____ Score: _____/100

Start time: _____ **End time:** _____ **Elapsed time:** _____

Criteria	Points earned
1. The group clearly states their topic including a general discussion of the topic background and the specific experiment chosen to illustrate one aspect of the topic.	/10
2. The group clearly states the research question and hypothesis, and how it relates to the topic.	/5
3. The students provide clear explanations of all aspects of the poster.	/10
4. Closure includes a review or summary of the research question, hypothesis, experimental results, and conclusions.	/10
5. Questions are answered clearly and concisely by all members of the group.	/8
6. All members of the group participate equally in the presentation.	/5
7. The scope and detail of the work is at an appropriate level.	/5
8. Presentation is of appropriate length. (see syllabus)	/2
9. The poster is well-organized, easy to read and includes a title and the names of all group members.	/10
10. The poster includes a well-stated research question and hypothesis.	/5
11. The poster includes an introduction including background of the topic and the specific experiment chosen to illustrate one aspect of the topic..	/10
12. The poster includes a list of the materials used and a step-by-step experimental procedure.	/5
13. The poster presents the results effectively with tables and graphs.	/10
14. The conclusions are clearly stated and clearly related to the	

original hypothesis.	/5
TOTAL POINTS	

INDIVIDUAL REPORT EVALUATION FORM

SCI 102 Fall 2013 Dr. Chinn

Name: _____ Score: _____/50

Activity/Experiment: _____

Criteria	Points earned
1. A general discussion of the background of the topic is included. (e.g. What is water? What happens between water molecules? How does the interaction affect the properties of water? How do these properties relate to real life?)	/10
2. A clear explanation of why the group chose the specific experiment to illustrate one aspect of the assigned topic is included.	/5
3. A description of the research question and hypothesis is included.	/5
4. The experimental design (not step-by-step procedure) used to test the hypothesis is included.	/5
5. A summary of the results of the experiment is included.	/5
6. A discussion of additional experiments to further the understanding of the topic and/or ways to improve the experimental procedure for better results is included.	/5
7. A description of what/how each member of the group contributed to the different parts of the project (i.e. what each person did) is included.	/3
8. What you learned about proposing and testing a hypothesis relating to a specific researched topic is included.	/5
9. Problems encountered with group projects and how you would address these problems in the classroom is included.	/5
10. Proper formatting and length were observed. (see syllabus)	/2
TOTAL POINTS	

Answers to Liberal Studies Questions

1) If multiple instructors are needed for lab sections, the department chairperson will appoint one of the professors assigned to teach the course as the course coordinator. The coordinator is responsible for preparing a lab schedule, in cooperation with other faculty who teach the course, for supervising work-study students, for ordering supplies for all lab sections, and for maintaining the supplies and equipment stores. The coordinator is in charge of organizing a meeting with all of the instructors prior to the beginning of each semester the course is being offered. This meeting will ensure syllabi and scheduled activities are basically equivalent among faculty assigned to this course. The coordinator will also distribute the laboratory preparation and cleanup equitably among all faculty members teaching the course in any given semester. The coordinator will insure that any faculty members who have not previously taught the course are adequately mentored to provide the best possible experience for the students. This may involve weekly meetings to discuss each lab exercise or other mentoring activities.

2) The content of SCI 102 is primarily based on essential concepts of chemistry and skills necessary for creative, quantitative problem-solving. As such, few concepts are uniquely associated with an individual, and those that are date from at least 80 years ago, when regrettably few women and minorities were playing notable roles in science. The contributions of such pioneering female scientists and Marie Curie and Lise Meitner are included. Students will also examine how issues of science and technology differentially affect disadvantaged groups, who are often racial minorities in this country, as well as residents of developing countries. For instance, the unequal distribution of world energy usage, and the problems associated with raw materials necessary for that usage, will be addressed.

3) As a part of the projects in this course, students will read and present appropriate articles from journals such as *Journal of Chemical Education, Science and Children,* and *Dragonfly*. These articles will be a part of classroom discussions, and also serve as the basis for some of the inquiry-based learning activities designed by the students.

4) This is one of a series of science courses designed specifically for Early Childhood Pre-K-4/Special Education majors. Rather than having the primary aim to educate students about particular scientifically derived knowledge in preparation for more advanced study, the current course has the aim of exposing students to a particular body of scientific content so that they can effectively teach young children about the impacts of their own decisions and behaviors on the natural world.