Course Narrative for Foundational Studies Course Proposal
Chemistry 100 – Chemistry: Reactions and Reason

We live in a world that is shaped by science and technology. There are few aspects of our lives that are not, in some way, influenced by science. Many pressing social problems as well as the solutions to these problems are inextricably linked with science and its application.

Chemistry 100 includes discussions of the fundamentally interdisciplinary nature of science. Chemistry 100 emphasizes the development of skills and abilities associated with scientific inquiry. It focuses upon the development of critical thinking and problem-solving skills.

Through the investigation of a series of current issues such as renewable energy, environmental pollution, and global warming students develop skills and abilities in the application of scientific principles through observation, inference, experimentation, and classification. Students also explore the construction of scientific explanations through the interpretation of data, critical thinking, and logic that links evidence to explanation. Students explore the formulation of scientific models while recognizing that valid alternative explanations may exist after skeptical review. Students gain experience in communicating ideas through written assignments and classroom discussion.

With the Foundational Studies Science and Laboratory learning objectives in mind, Chemistry 100 takes a topics-based approach to teaching chemistry. Course content is introduced to students in the context of current issues. There are three main objectives in this course. The first objective is to instill an awareness and understanding of the major scientific and technological issues facing all of us as citizens when we cast our votes for political candidates who espouse certain positions on scientific issues. This includes encouraging students to exercise an appropriate degree of skepticism when developing opinions and making important decisions. The second objective is to help students realize that they do not live in a vacuum, and the issues facing them on a daily basis are not nicely compartmentalized as they often seem to be when explored in university courses. Complex issues tend to encompass scientific, economic, sociological, and political components. The third objective is to encourage an appreciation of science and the fundamental role that it plays in the phenomena that we observe in our everyday lives and to spark student curiosity about science beyond the confines of their experiences as university students.

The primary function and role of Chemistry 100 as a Foundational Studies course is to help students achieve a higher level of scientific literacy. Scientific literacy can be described as the knowledge and understanding of scientific concepts and processes required for participation in civic and cultural affairs, economic productivity, and personal decision making. Scientific literacy provides an individual with the tools to formulate answers to questions derived from curiosity about everyday experiences. It also encompasses the ability to describe, explain, and predict natural phenomena. It allows students to read with understanding articles about science in the popular press and engage in social conversation about the validity of scientific conclusions. Students who have gained a degree of scientific literacy can identify scientific issues underlying national and local political issues and express positions that are scientifically and technologically informed. Scientific literacy confers the capacity to pose and evaluate arguments based upon evidence and to apply conclusions from such arguments appropriately.

Student performance will be assessed by the extent to which they are able to master fundamental scientific concepts and explain them clearly and concisely. Students will be expected to employ critical thinking in the solution of scientific and technological problems that challenge our global society.

CHEMISTRY 100 SYLLABUS

Course: Chemistry 100 - Chemistry: Reaction and Reason
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Office hours: MFW 10:00-10:50
Text: Chemistry Matters, S.K. Allen and J.M. Allen, Kendall Hunt (2008)

Blackboard Site accessible via your ISU Portal

I. Course Description:

The primary objective of Chemistry 100 is to help students achieve a higher level of scientific literacy. Scientific literacy is the knowledge and understanding of scientific concepts and processes required for participation in civic and cultural affairs, economic productivity, and personal decision making. A scientifically literate person can explore and determine answers to questions derived from curiosity about everyday experiences. Scientific literacy encompasses the ability to describe, explain, and predict natural phenomena. It also confers the ability to read with understanding articles about science in the popular press and engage in social conversation about the validity of scientific conclusions. Scientific literacy empowers a person to identify scientific issues underlying national and local issues and express positions that are scientifically and technologically informed. Scientific literacy also provides a person with the capacity to pose and evaluate arguments based upon evidence and to apply conclusions from such arguments appropriately.

Chemistry 100 is a Science and Laboratory Foundational Studies course in chemistry. This course is intended for students who wish to have a general introduction to chemistry and assumes no previous coursework in chemistry. This course is not intended to prepare students to enroll in upper-level coursework in chemistry. It has been developed for students who wish to gain a broad-based understanding of the fundamental concepts of science with a concentration upon chemistry. This conceptual foundation will provide the basis for exploring a range of topics including: alternative sources of energy, industrial pollution, global warming, toxic agents, and human nutrition.

Students taking Chemistry 100 should be currently enrolled in, or have previously completed, Chemistry 100L. Chemistry 100 and 100L are intrinsically linked. The experiments in Chemistry 100L are designed to illustrate and to amplify the topics covered in Chemistry 100.

II. Learning Objectives

Chemistry100/100L fulfills the Science and Laboratory requirement of the Foundational Studies Program. The course also satisfies the Science and Mathematical Studies Foundational requirements of the General Education 2000 program. Chemistry 100 was designed to meet the following goals and objectives:

Foundational Studies Program Goals:

The Foundational Studies Program was designed to meet the following goal: Students should be able to analyze problems, think critically and creatively, integrate a variety of approaches to gain knowledge, recognize the ethical, social, and cultural implications of issues, and communicate professionally, persuasively and effectively on the day they graduate.

Program Objectives (PO):

1. Locate, critically read, and evaluate information to solve problems;
2. Critically evaluate the ideas of others;
3. Apply knowledge and skills within and across the fundamental ways of knowing;
4. Demonstrate an appreciation of human expression through literature and fine and performing arts;
5. Demonstrate the skills for effective citizenship and stewardship;
6. Demonstrate an understanding of diverse cultures within and across societies;
7. Demonstrate the skills to place their current and local experience in a global, cultural, and historical context;

8. Demonstrate an understanding of the ethical implications of decisions and actions;
9. Apply principles of physical and emotional health to wellness; and
10. Express themselves effectively, professionally, and persuasively both orally and in writing.

Chemistry 100 contributes to student learning in the Foundational Studies Program by addressing all program objectives, except PO-4 and PO-6. The following are representative examples of course topics and assignments that pertain to program objectives.

PO-1: Students will be required to do library and/or Internet research along with careful reading of the textbook in order to perform well on tests and exams. Tests and exams in Chemistry 100 require students to apply acquired knowledge to answer questions and solve problems. Library and/or Internet research is also required as part of the Friday forums.

PO-2: Many topics covered in Chemistry 100 involve a critical evaluation of the ideas of others. For example, classroom discussions of global warming include critical evaluations of the evidence that supports the argument that global warming is a serious threat to the environment as well as the argument that human activity is having no real impact upon climate.

PO-3: Students are introduced to science as a way of knowing via classroom discussions that are designed to contrast science with other ways of knowing including, for example, religious belief. Science is based upon skepticism while religious belief is based upon the acceptance of scriptural authority. Students are encouraged to explore cases such as evolution of species where these two ways of knowing result in conflict.

PO-5: A basic knowledge of science is absolutely essential to good citizenship because so many issues of great concern to all citizens are based upon science and technology. Students grapple with such questions as How clean does drinking water have to be in order to be safe? Is there a reasonable cost-benefit analysis that can be applied to this question? Is there an acceptable level of risk? Who gets to decide what is constitutes a “reasonable” risk?

PO-7: Many technologies produce concerns that are local or regional while others are of global concern. For example, acid rain is a regional problem, but global warming is a global problem. How can the U.S. and European countries halt global warming by a reduction in greenhouse gas emissions if India and China do not also reduce these emissions? What right do developed countries have to prevent developing countries from emitting greenhouse gases?

PO-8: Many scientific and technological issues are inextricably bound to moral and ethical issues. Is it ethical to use nuclear reactions to generate electricity given our currently inadequate technological ability to store radioactive waste for as long as it remains toxic? Is animal testing of new human drugs morally defensible?

PO-9: Extensive classroom discussions of chemical toxicology and drug use are conducted in Chemistry 100. Is marijuana a dangerous drug or a useful medication that can relieve suffering? How does excessive consumption of carbohydrates lead to increased risks for obesity? Is cigarette smoking more hazardous than eating fast food? Is moderate consumption of alcoholic beverages associated with poor health or is it beneficial to health?

PO-10: Students are required to submit written assignments on a regular basis as part of the Friday forums.

Science and Laboratory Course Goals:

Chemistry 100 satisfies a portion of the Science and Laboratory requirements of the Foundational Studies Program. In doing so Chemistry 100 meets the Science and Laboratory course objectives listed below:

Course Objectives (CO):

1. Articulate how data are acquired, and how hypotheses and theories are constructed;
2. Use the scientific method to formulate and test hypotheses;

3. Apply scientific theories to predict the nature and behavior of new systems, environments, or scenarios; and
4. Articulate how current issues in science and technology intersect with populations, institutions, and societies.

The following are selected examples of course topics and assignments that address these objectives:

CO-1: Through the use of numerous examples, students learn that observations lead to data, that data lead to the formulation of hypotheses, and that hypotheses are tested by performing experiments. In many case study examples, students learn the importance of recognizing that all scientific knowledge is tentative and always open to revision.

CO-2: A useful illustration of how the scientific method works is provided by a visit to the doctor's office. Students have all visited the doctor's office. A good physician is, first and foremost, a good scientist. Observations are made and data such as height, weight, and temperature are collected. A hypothesis in the form of a tentative diagnosis is made and tested by experiment (e.g., prescribing an antibiotic). The basic steps used in the scientific method are highlighted by the use of many other examples from the history of science.

CO-3: Students in Chemistry 100 discuss many examples of the predictive power of scientific theories including the famous "gold foil" experiments done by Ernest Rutherford in class. The data derived from these experiments led to doubts regarding the validity of an earlier theory developed by J.J. Thomson called the "plum pudding model" regarding the structure of the atom. What was already known about the interactions of charged particles was applied to the results from these new experiments. It was clear that the "plum pudding" model of the atom had to be discarded in favor of a model for the atom that includes a massive, positively-charged nucleus. The chain of reasoning used by Rutherford also becomes clear to Chemistry 100 students.

CO-4: Students learn that oxidizing agents such as chlorine, bromine, and ozone are powerful disinfectants. Chlorine is used extensively as a disinfectant in swimming pools, bromine is used in hot tubs, and ozone is used in drinking water disinfection. Students learn that drinking water supplies that are left untreated in many areas of the world lead to millions of human deaths each year. Students also learn, much to their surprise, that improperly treated hot tubs pose a serious risk for genital herpes infections- a significant public health issue.

Skill and Applied Learning Objectives:

As a Foundational Studies course, Chemistry 100 satisfies the following skill and applied learning objectives:

Skill and Applied Learning Requirements (SALR):

1. Develop critical thinking skills;
2. Develop information literacy skills; and
3. Include a graded writing component.

Skill and Applied Learning Requirements will be addressed as follows:

SALR-1: Critical reasoning is a key component of any science course. Non-science students learn the importance of critical thinking in Chemistry 100 by an examination of a wide range of topics that lead to questions which require, by their very nature, the application of critical thinking. Students explore such questions as How can the U.S. reduce it's dependence upon imported foreign oil? What new technologies need to be developed in order to efficiently produce solar electricity?

SALR-2: Students must learn how to find reliable information. Many students take information that they find on the Internet at face value? Chemistry 100 students are engaged in classroom discussions regarding the reliability of information found on the Internet relative to that found in peer-reviewed literature.

SALR-3: Friday forums provide students in Chemistry 100 with regular writing assignments.

Chemistry 100 Course Goals:

The primary goal of Chemistry 100 is to help students achieve a higher level of scientific literacy. As discussed above, scientific literacy involves knowledge and understanding of scientific concepts and processes required for participation in civic and cultural affairs, economic productivity, and personal decision making.

III. Class Policies

Students are expected to attend class, to keep up with reading assignments, and to participate in classroom discussions.

Attendance: Although I do not have a mandatory attendance policy, I have found that those students who attend class regularly generally earn higher grades.

Assignments and exams: All exams must be taken at the assigned time. Makeup exams will be given only when arranged before the exam day. If you miss an exam for any reason, I must be notified by 4:00 PM of the day of the exam. No late exams will be given without a note from a physician. Makeup exams must be taken within one week of the scheduled exam.

Americans with Disabilities Act Statement: Indiana State University seeks to provide effective services and accommodation for qualified individuals with documented disabilities. If you need an accommodation because of a documented disability, you are required to register with Disability Support Services at the beginning of the semester. Contact the Director of Student Support Services. The telephone number is 237-2301 and the office is located in Gillum Hall, Room 202A. The Director will ensure that you receive all the additional help that Indiana State offers. If you will require assistance during an emergency evacuation, notify your instructor immediately. Look for evacuation procedures posted in your classrooms.

Laptop Usage: Laptop Not Required for Course: Usage Permitted. While there will be no assignments or examinations for which the laptop will be used, your use of a laptop is generally permitted as long as such usage remains within the bounds of the Code of Student Conduct and it conforms to the provisions of its use as laid out in this syllabus. There may be occasions where laptop usage is forbidden and if that occurs, failure to comply with this direction will be viewed as a violation of the Code of Student Conduct.

Academic Freedom: Teachers are entitled to freedom in the classroom in discussing their subject, but they should be careful not to introduce into their teaching controversial matter which has no relation to their subject." The preceding comes from the American Association of University Professors statement on academic freedom. Though the entire statement speaks to many issues, it is this portion on the conduct of the course that is most relevant. For the purpose of Foundational Studies courses this means that faculty have the right to conduct their class in a fashion they deem appropriate as long as the material presented meets the learning objectives laid out by the entire faculty.
http://www.aaup.org/AAUP/pubsres/policydocs/contents/1940statement.htm

Academic Integrity: Plagiarism and other forms of cheating will not be tolerated. Depending of the nature of the assignment and the seriousness of the offense, penalties range from no credit given for the assignment to a failing grade in the course to suspension or expulsion as determined by Student Judicial Programs. The Student Guide to Academic Integrity can be found at:
http://web.indstate.edu/academicintegrity/studentguide.pdf

IV. Course Expectations

Grading:

Tests (5)	Test 1 - 50 pts.
	Test 2 - 50 pts.
	Test 3 - 50 pts.
	Test 4 - 50 pts.
	Final - 100 pts.
Friday Forums	Total - 100 pts.

Grades will be determined using a fixed scale:

A^+ - 98-100	A - 94-97	A^- - 90-93	B^+ - 87-89	B - 84-86	B^- - 80-83

C^+ - 77-79 C - 74-76 C^- - 70-73 D^+ - 67-69 D - 64-66 D^- - 60-63
F - Below 60

Outline of the course:

Unit 1 Chemistry: The Central Science

Chapter 1: The History of Atomic Theory: Standing on the Shoulders of Giants.

It is said that truth is stranger than fiction. This statement is certainly true with regard to science. There are a wide variety of strange and exciting tales woven into the fabric of chemical history. Hopefully, you will become so interested in the story of chemistry that you learn about the science of chemistry as a natural response to your curiosity. The topics covered in this section will give you an opportunity to recognize the choices made by previous societies and understand the effects of these choices upon the evolution of scientific knowledge and technological developments.

Program objectives addressed: PO-1, PO-2
Course objectives addressed: CO-1, CO-2

Chapter 2: What Do We Know and How Do We Know it?

The purpose of this material is to challenge students to rise above the everyday concerns of life and look at the extraordinary technological advances brought about by science that have a direct impact on modern life. Since technology, like science, is a human endeavor, what we choose to study and how we choose to use the knowledge gained from our studies are issues that must be evaluated by society as a whole. All citizens should understand that unless they take part in the decision making process regarding the use of science and technology, someone else will make important decisions for them. In order to play a meaningful role in making such decisions, all citizens need to have a basic understanding of science. All of us must be able to distinguish between those questions that can be answered using science and those for which science has no answers. What will be emphasized here is the uniqueness of the scientific approach to gaining knowledge contrasted with the means by which knowledge is accumulated by human activities in other disciplines such as art, history, or sociology.

Program objectives addressed: PO-3, PO-5, PO-7
Course objectives addressed: CO-4

Chapter 3: Chemistry: The Science of Stuff

Many may feel an inexpressible serenity as they view our natural surroundings at such places as the rim of the Grand Canyon. Such emotions are an incomplete picture within an understanding of the "science of stuff" that explains the origins and genesis of the universe around us. The purpose of this topic is to heighten student appreciation for the awareness of nature by describing the amazing complexity of common, everyday substances and the changes that these substances undergo.

Program objectives addressed: PO-7
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Unit 2 Energy: The Driving Force of the Universe

Chapter 4: Explosives

Many students seem to have an innate interest in explosives and explosions. It is important to remember that explosives have had an enormous impact on human history for both good and evil. Every American knows where they were when terrorists attacked the Twin Towers in New York City. But, many students are unaware of the enormous contributions made by the development of explosives for peaceful, constructive purposes. In order to understand how explosions occur it is necessary to understand how

certain types of chemical reactions rapidly release large amounts of energy and generate large quantities of gases. This topic also requires an understanding of some of the basic gas laws and a brief introduction to the subject of chemical kinetics.

Program objectives addressed: PO-2, PO-5, PO-7
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Chapter 5: Energy for Today and Tomorrow

Throughout human history, as societies have become more advanced, their energy consumption has increased. In 2008, the United States imported 57 percent of its oil, sending $342 billion out of the country. Nearly three-quarters of this imported oil was used for transportation fuels. Where do industrial nations such as the U.S. find new sources of energy? How is energy used and what are the benefits and costs associated with those sources of energy? An examination of fossil fuels such as coal and crude oil, nuclear, hydroelectric, wind, and solar power generation will be undertaken. Students will be asked to address the impacts associated with energy use and conservation of natural resources.

Program objectives addressed: PO-5, PO-7, PO-8
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Unit 3 The Environment

Chapter 6: The Air That We Breathe

As passengers on this fragile spacecraft called Earth, we are dependent upon its vulnerable and limited resources for life itself. In this section, case studies are used to introduce issues associated with air pollution derived from human activities. In order to gain an understanding of what a “polluted” environment is, it is necessary to first discuss the natural unpolluted environment. A discussion of some severe episodes such as the London smogs of the 1950’s serves as an introduction to the seriousness of this issue. Other topics here include acid rain, tropospheric ozone pollution, stratospheric ozone depletion, and global warming. (

Program objectives addressed: PO-1, PO-2, PO-5, PO-8
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Chapter 7: Fresh Water: Is it Plentiful and Safe?

Carol Browner, the former head of the EPA asked the question: “How clean is clean?” Water is one of our most precious resources- we drink it, we swim in it, we take food from it. Without it, there literally would be no life on earth. Because water is so familiar to us, we think of water as ordinary. However, water is far from ordinary. Students will explore the unique chemical properties of water. Water is a powerful solvent that can dissolve many other chemical substances that are essential to life and many chemical substances that pose serious threats to life. Students will explore the importance of acids and bases and the use of the pH scale to describe their concentrations. An examination of water pollution including toxic metals, pesticides, herbicides, solvents, and micro-organisms will allow students to gain an understanding of the complexity of this issue. Finally, a discussion of how polluted water is treated to make it suitable for drinking is discussed. This will involve an examination of oxidation and reduction as well as the use of important oxidizing agents.

Program objectives addressed: PO-1, PO-2, PO-5, PO-8
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Unit 4 Carbon: the Building Blocks of Our Living World

Chapter 8: For the Love of Diamonds

Diamonds have been sought after since ancient times for their brilliance and fire. They have been a source of wealth, fear, and greed. Diamonds are a form of pure carbon. Other forms of pure carbon include graphite and fullerenes. What makes pure carbon form black, greasy graphite and beautiful hard, sparkling diamonds?

Program objectives addressed: PO-1, PO-2, PO-5, PO-7
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Chapter 9: A World of Molecules

Carbon is an element with some interesting properties that allow it to form long chains and rings of carbon atoms that can also include the atoms of other elements. Many of the distinctive properties of organic compounds depend not only upon the structural arrangement of the carbon atoms, but also on the presence of functional groups attached to the carbon backbone. Through a series of questions, students will be challenged to consider the unique properties that each functional group brings to organic molecules. Why are alkyl halides good solvents and pesticides? Why does the caffeine in coffee give you a "boost" in the morning? The possibilities for formation of unique substances is nearly endless. Students will explore hydrocarbons, alkyl halides, alcohols, ethers, aldehydes, ketones, carboxylic acids, amides, amines, and nitro compounds. Important examples of each class of organic compound will be discussed in the context of their importance in everyday life.

Program objectives addressed: PO-2, PO-9
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Unit 5 Nutrition: We are What We Eat

Chapter 10: Carbohydrates: How Sweet it is.

According to the U.S. Surgeon General, one-fourth of all fourth graders in the U.S. are considered obese. What is causing so many children to be overweight? Students will consider the chemical structure of carbohydrates. Carbohydrates store energy. How is this energy released by metabolism? What are empty calories? An investigation of these and other questions in this section will introduce students to carbohydrates and the importance of carbohydrate metabolism.

Program objectives addressed: PO-1, PO-2, PO-9
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Chapter 11: What Makes Cholesterol "Good" or "Bad"?

Take a walk down any aisle in your local grocery store. It is hard to find items that are not labeled fat-free or low-fat. Why are we concerned with dietary fat? Do we need fat in our diets? Students will examine the structure and chemical properties of cholesterol. What is it about fats and some forms of cholesterol that make them harmful? How can some forms of cholesterol actually be beneficial? Students will examine the role of cholesterol as a starting material for the synthesis of a wide variety of important biomolecules in living organisms.

Program objectives addressed: PO-1, PO-2, PO-9
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Chapter 12: Proteins: Do They Hold the Key to the "Fountain of Youth?"

The word "protein" is derived from the Greek word *proteios*, meaning of first importance. Proteins do much more than just build muscle. The purpose of this section is to investigate protein structure and metabolism and discuss the role of protein chemistry in ageing.

Program objectives addressed: PO-1, PO-2, PO-9

Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Unit 6 Forensic Chemistry

Chapter 13: The War on Drugs

Our society has collectively decided to make the possession of some drugs of legal and to outlaw the possession of others. What is a drug? Some drugs are prescribed by physicians in order to treat illness and disease while other drugs are used recreationally. Are alcohol and tobacco drugs? Are they safe because they are legal to possess? Students will investigate the chemistry of a variety of drugs from their structures to their effects on the human body. A discussion of the differences between narcotic, hallucinogenic, stimulant, and depressant drugs will help students to understand the range of chemical substances that are used as recreational drugs. In the process students will be challenged with such questions as: Should marijuana be legalized? Are anti-drug media campaigns effective?

Program objectives addressed: PO-1, PO-2, PO-5, PO-8, PO-10
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Chapter 14: The Chemistry of Poisons

The old adage "Everything in moderation" was good advice because everything is toxic at high enough dosages. Students will be introduced to the science of toxicology in this section. Topics will include caustic and metabolic poisons, neurotoxins, teratogens, and carcinogens. How can science, particularly chemistry, ensure a safe environment? How low is low enough when it comes to exposure to toxic chemical substances? Are we willing to accept a certain amount of illness or a number of deaths in order to avoid spending large amounts of money to clean-up the environment? (PO-1), (PO-2), (PO-5), (PO-6), (PO-7), (PO-8), (PO-10), (CO-1), (CO-2), (CO-3), (CO-4)

Program objectives addressed: PO-1, PO-2, PO-5, PO-6, PO-7, PO-8, PO-10
Course objectives addressed: CO-1, CO-2, CO-3, CO-4

Friday Forums:

Every Friday, except on exam days, you will be assigned a topic to discuss. You will be given some class time to work on this activity. You may use your textbook, internet, library, and other source materials. In order to get credit for this activity, you must add a thread to a Blackboard discussion and post your findings. Your posting should be at least two paragraphs in length and should include one paragraph summarizing an article that you have read pertaining to the topic and one paragraph summarizing your views on the subject. You must provide the citation information for the article.

All ten issues for the Friday Forums will be posted at 8:00 AM August 26th. You are free to post your assignments any time until that forum closes. The closing times for each forum are given at the end of the forum description. You are expected to participate in the discussion during the available time. Your participation will be graded with a total of 10 possible points for each of the ten Friday Forum discussion periods. It is your responsibility to make sure that your comments are posted on Blackboard. Please check your postings. You will get credit for the assignment only when your assignment has been posted on Blackboard.

Program objectives addressed: PO-10
Skill and applied learning objectives addressed: SALR-1, SALR-2, SALR-3

Friday Forum 1

Unit 1 begins with an opening article which describes the means by which stem cell research is funded. Who should fund stem cell research? Can science be separated from public policy or does it play a crucial role in public policy? Closes Sept 11th

Friday Forum 2

Albert Einstein stated, "Imagination is more important than knowledge." Do you agree or disagree? Explain.
Closes Sept. 18th

Friday Forum 3

From your investigation, what is the current level of threat to the United States from terrorists? Which weapon is the most likely weapon terrorists would use? What are some of the measures that the U.S. government and you a citizen could incorporate to guard against such a threat?
Closes Sept. 25th

Friday Forum 4

In an effort to reduce our dependence on foreign oil, the United States Department of Energy (DOE) funds research into alternative energy production methods. In your opinion, which of the alternative methods for producing energy has the best chance of success in today's market? Explain why you believe it to be superior to the other alternate sources of energy that we have discussed in class.
Closes Oct. 2nd

Friday Forum 5

Water fluoridation is the practice of adding fluoride compounds to water with the intended purpose of reducing tooth decay in the general population. Most of the municipalities in the United States fluoridate their water supplies. Fluoride is typically added to potable water in the form of sodium hexafluorisilicate or hexafluorosilicic acid, at levels between 0.7 and 1.2 ppm. Fluorides such as sodium fluoride (NaF), sodium monofluorophosphate ("SMFP" or "MFP", Na_2FPO_4), tin (II) fluoride (stannous fluoride, SnF_2), are common ingredients in toothpaste. After reading several literature sources including Text Box 7-2 in your textbook, do you think that public drinking water should be fluoridated?
Closes Oct. 16th

Friday Forum 6

You step up to the cash register at the grocery store with your milk, eggs, and cereal and the cashier asks the inevitable question: "Will it be paper or plastic?" After your investigation of the literature and after reading Text Box 11-2 in your textbook, how should you answer the question?
Closes Oct. 23rd

Friday Forum 7

What are food manufacturers trying to say about their products when they place "No Sugar Added" on the label? What does the labeling imply about such products? Can such products be high in calories?
Closes Oct. 30th

Friday Forum 8

Fish oil contains omega-3-fatty acids. These essential fatty acids have been a topic of scientific investigation-especially since around 1985. Are fish oil supplements beneficial to your health? After your investigation and reading Text Box 11-2, how would you answer this question?
Closes Nov. 6th

Friday Forum 9

Which of the theories of aging discussed in Chapter 12 of your textbook is the most convincing? Why do people age? Can we delay the onset of old age and the diseases that are associated with it?

Closes Nov. 13th

Friday Forum 10

Chapter 13 of your textbook begins with an article entitled "The Forgotten War on Drugs" Are we winning the war on drugs? Should all drugs be legalized? What about marijuana- is it harmful or should it be legalized? Closes Nov. 20th

CHEMISTRY 100L SYLLABUS

Course: Chemistry 100L - Chemistry: Reaction and Reason Laboratory
Professor: Dr. John M. Allen, Office; 051H; Phone: X-2237; e-mail: jallen11@indstate.edu
Office hours: MFW 10:00-10:50
Text: Chemistry Experiments for General Education, 4th Ed.
Author: S.K. Allen and J.M. Allen

Blackboard Site accessible via your ISU Portal

I. Course Description:

The primary objective of Chemistry 100 and its associated laboratory is to help students achieve a higher level of scientific literacy. Scientific literacy encompasses the knowledge and understanding of scientific concepts and processes required for participation in civic and cultural affairs, economic productivity, and personal decision making. A Scientifically literate person can formulate answers to questions derived from curiosity about everyday experiences. It also encompasses the ability to describe, explain, and predict natural phenomena. It affords a person the ability to read with understanding articles about science in the popular press and engage in social conversation about the validity of scientific conclusions. A scientifically literate person can identify scientific issues underlying national and local issues and express positions that are scientifically and technologically informed. Scientific literacy also provides the capacity to pose and evaluate arguments based upon evidence and to apply conclusions from such arguments appropriately.

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Students taking Chemistry 100 should be currently enrolled in, or have previously completed, Chemistry 100L. Chemistry 100 and 100L are intrinsically linked. The experiments in Chemistry 100L are designed to illustrate and to amplify the topics covered in Chemistry 100.

II. Learning Objectives

Chemistry 100/100L fulfills the Science and Laboratory requirement of the Foundational Studies Program. The course also satisfies the Science and Mathematical Studies Foundational requirements of the General Education 2000 program. Chemistry 100L was designed to meet the following goals and objectives:

Science and Laboratory Course Goals:

Chemistry 100L satisfies a portion of the Science and Laboratory requirements of the Foundational Studies Program. In doing so Chemistry 100L meets the Science and Laboratory objectives listed below:

Laboratory Objectives (LO):

1. Engage in laboratory experience that reinforces and augments the theoretical content of the lecture course;
2. Use the scientific method to formulate and test hypotheses;
3. Use tools and techniques of the discipline to gather and analyze data; and
4. Present the analysis and findings of the lab experience.

LO-1: Chemistry 100L includes experiments that illustrate some of the most fundamental principles in chemistry. For example, students perform a chemical reaction in which careful measurements of the masses of reactants and products allow them to directly observe that the law of conservation of matter (mass) is obeyed in their experiment.

LO-2: Students must frequently apply the scientific method in Chemistry 100L experiments. For example, several observations are made by students when a chemical reaction is known to be occurring. These observations are used

to develop an hypothesis regarding what phenomena are always observed during a chemical reaction. Then, students conduct a number of experimental procedures, some of which involve chemical reactions, and some of which do not. Students must determine which procedures involve chemical reactions and which do not.

LO-3: Students in Chemistry 100L are immediately introduced to the use of graphs to represent experimental data, analytical balances for measurement of mass, the use of volumetric glassware such as pipets, burets, and graduated cylinders, as well as Bunsen burners, and crucibles. Students are also introduced to filtration, sublimation, and chromatography.

LO-4: Students present the finding of their laboratory experiments in the laboratory report that must be completed after each experiment and turned in the following lab period. These reports include post-lab questions that are in an essay format. These questions are frequently integrative in nature and thus require the student to combine knowledge gained from the Chemistry 100 lecture course and previous lab experiences with the current laboratory exercise in order to answer these questions.

Chemistry 100 Course Goals:

The primary goal of Chemistry 100 is to help students achieve a higher level of scientific literacy. As discussed above, scientific literacy involves knowledge and understanding of scientific concepts and processes required for participation in civic and cultural affairs, economic productivity, and personal decision making.

III. Class Policies

Attendance: You are expected to complete all scheduled laboratory experiments. Please note that missed laboratory experiments **CANNOT** be made-up. Please plan on arriving to the laboratory on time. Students who arrive late will not be allowed to participate.

Assignments and Exams: Pre-lab summaries and pre-lab questions must be completed before coming to lab. Students who do not have their pre-lab summaries and pre-lab questions completed will not be allowed to participate. All laboratory report sheets must be turned at the beginning of the next laboratory class. All exams must be taken at the assigned time. Make-up exams will only be given when arranged before the exam day. If you miss and exam for any reason, I must be notified by 4:00 PM of the day of the exam. No late exams will be given without a note from a physician. Make-up exams must be taken within one week of the scheduled exam.

Americans with Disabilities Act Statement: Indiana State University seeks to provide effective services and accommodation for qualified individuals with documented disabilities. If you need an accommodation because of a documented disability, you are required to register with Disability Support Services at the beginning of the semester. Contact the Director of Student Support Services. The telephone number is 237-2301 and the office is located in Gillum Hall, Room 202A. The Director will ensure that you receive all the additional help that Indiana State offers. If you will require assistance during an emergency evacuation, notify your instructor immediately. Look for evacuation procedures posted in your classrooms.

Laptop Usage: Laptop Not Required for Course: Usage Permitted. While there will be no assignments or examinations for which the laptop will be used, your use of a laptop is generally permitted as long as such usage remains within the bounds of the Code of Student Conduct and it conforms to the provisions of its use as laid out in this syllabus. There may be occasions where laptop usage is forbidden and if that occurs, failure to comply with this direction will be viewed as a violation of the Code of Student Conduct.

Academic Freedom: Teachers are entitled to freedom in the classroom in discussing their subject, but they should be careful not to introduce into their teaching controversial matter which has no relation to their subject." The preceding comes from the American Association of University Professors statement on academic freedom. Though the entire statement speaks to many issues, it is this portion on the conduct of the course that is most relevant. For the purpose of Foundational Studies courses this means that faculty have the right to conduct their class in a fashion they deem appropriate as long as the material presented meets the learning objectives laid out by the entire faculty.
http://www.aaup.org/AAUP/pubsres/policydocs/contents/1940statement.htm

Academic Integrity: Plagiarism and other forms of cheating will not be tolerated. Depending of the nature of the assignment and the seriousness of the offense, penalties range from no credit given for the assignment to a

failing grade in the course to suspension or expulsion as determined by Student Judicial Programs. The Student Guide to Academic Integrity can be found at:
http://web.indstate.edu/academicintegrity/studentguide.pdf

Laboratory Safety: Safety goggles must be worn at all times when you are in the laboratory.Any violation of the safety rules will result in immediate expulsion from the laboratory. Before coming to lab, you should read the assigned experiment and complete the pre-lab summary and the pre-lab questions noting any special safety precautions. You will be expected to clean your work area before leaving the lab

IV. Course Expectations

Grading:

Laboratory Reports	70%
Laboratory Midterm	15%
Laboratory Final	15%

Grades will be determined using a fixed scale:

A^+ - 98-100	A - 94-97	A^- - 90-93
B^+ - 87-89	B - 84-86	B^- - 80-83
C^+ - 77-79	C - 74-76	C^- - 70-73
D^+ - 67-69	D - 64-66	D^- - 60-63
F - Below 60		

You must pay close attention and take notes during the pre-lab lecture prior to performing each experiment. You must keep a careful written record of the data collected during each experiment on the data sheets provided in your lab book. You will be expected to provide written answers for the post-lab questions at the end of each experiment. The data sheets and post-lab questions constitute the lab report that must be turned in the following week for credit (SALR-3).

Schedule of Laboratory Experiments:

The four Foundational Studies Area Learning Objectives (LO-1, LO-2, LO-3, LO-4) for the Science Laboratory Experience are addressed in each of the following 13 experiments.

1/8 Pick up syllabus and check in
View safety film
Sign and return safety sheet

1/22 Experiment 1: Systems of Measurement

Learning objectives
1. Familiarity with the SI system of units and to make measurements using these units
2. Development of skills in measurement of length, volume, temperature, and mass and report these data in SI units
3. Familiarity with the importance of significant figures in measurement and in calculations
4. Calculation of percent error for the results obtained from experimental measurements
5. Introduction to the use of graphical representation of experimental data

1/29 Experiment 2: Graphing

Learning objectives
1. Mass and weight- balances and scales

2. Basic principles of graph construction
3. Use of graphical representations to visualize the relationship between two variables
4. Use of a linear equation and calculation of the slope and y-intercept of a line
5. Understanding the meaning and significance of the slope and y-intercept
6. Interpretation of graphs where the experimental data do not pass through the origin

2/5 Experiment 3: Separation of Components in Mixtures

Learning objectives
1. Introduction to mixtures- heterogeneous and homogeneous
2. Elementary separation theory
3. Use of sublimation, decantation, filtration, and extraction for separation of mixtures
4. Solutions and solubility
5. Determination of the percentage of each substance in a mixture by mass
6. Calculation of percent recovery for each component in a simple mixture

2/12 Experiment 4: The Mole and Mass Relationships

Learning objectives
1. Explanations involving the basic conception of matter as composed of particles
2. Manipulation of the Bunsen burner. Characteristics of flames used for heating laboratory apparatus
3. Combustion reactions
4. Experience in the collection of quantitative data
5. Quantitative calculations using formulas and equations including calculation of theoretical yield and percent yield

2/19 Experiment 5: Chemical Changes

Learning objectives
1. Demonstrate that chemical reactions obey the law of conservation of matter
2. Distinguishing one substance from another by differences in physical properties
3. The use of observation in order to distinguish a chemical change from a physical change

2/26 Midterm Exam

3/12 Experiment: 6 Rates of Reactions

Learning objectives
1. Define and explore the meaning and significance of activation energy
2. Determination of the effect of temperature on the rate of a reaction
3. Determination of the effect of reactant concentrations on the rate of a reaction
4. The effect of catalysts on the rate of a reaction

3/19 Experiment: 7 Concentration of Acetic Acid in Vinegar

Learning objectives
1. Introduction to acids and bases
2. Discussion of differences between strong acids and bases and weak acids and bases
3. The pH scale
4. Acid-base neutralization reactions
5. Familiarity with the fundamental principles of analytical chemistry
6. Determination of the concentration of an acid in an aqueous solution by titration

3/26 Experiment: 9 Hydrocarbons

Learning objectives

1. Examination of some of the chemical and physical properties of hydrocarbons
2. Perform reactions that are characteristic of each class of hydrocarbon (i.e., alkanes, alkenes, alkynes, and aromatics)
3. To recognize the differences in terms of chemical and physical properties between some of the hydrocarbons found in everyday life

4/2 Experiment: 11 Separation of Dyes by Paper Chromatography

Learning objectives

1. Introduction to the theory and practice of chromatography. Discussion of filtration, centrifugation, distillation, and chromatography
2. Familiarity with chromatographic separation techniques with an emphasis upon paper chromatography
3. Use of the retention factor to make qualitative identifications of chemical substances present in mixtures
4. Calculation of retention factors for unknown substances and standards from experimental data and use of the retention factor to identify unknown substances

4/9 Experiment: 12 Carbohydrates

Learning objectives

1. Introduction to biochemistry
2. Familiarity with the structures of some of the most common carbohydrates
3. Examination of the physical and chemical properties of carbohydrates
4. Reducing and non-reducing properties of carbohydrates
5. Discussion of how carbohydrates are utilized by living organisms

4/16 Experiment: 13 Proteins

Learning objectives

1. Discussion of how the chemistry of both acids and amines apply to amino acids and proteins
2. The use of specialized chemical tests to distinguish between amino acids, peptides, and proteins
3. Isolation of casein from milk

4/23 Check out and final exam