

## **Inquiry in the Natural World Lab Syllabus**

Clare 102L (Clrl 102)

Spring 2008

**Credit Hours:** One Credit

**Prerequisites:** None (although concurrent registration in Clare 102 is required)

### **COURSE DESCRIPTION**

An introduction to the study of selected phenomena within the natural sciences by means of problem-based laboratory experiences. To make the course both multidisciplinary and interdisciplinary, the various scientific disciplines (physics, chemistry, and biology) are connected through common themes such as energy and the significance of patterns and regularity in nature.

### **COURSE PHILOSOPHY**

*Inquiry in the Natural World* is unlike other science courses. Rather than changing topics weekly to track the lecture course, we will focus on a limited number of topics that are interconnected so the experiences will build from one week to the next.

*Inquiry in the Natural World* is also different than other laboratory courses because the laboratory procedures may not be specified for you. Your group of two to four students will be given a problem, and it will be up to you to figure out how to solve it! This format forces you to work efficiently and effectively as a team. The laboratory experience is one of discovery rather than recapitulating worn out "follow the instructions" labs. You will proceed in the same way that scientists make new discoveries, by making observations, forming, testing, and evaluating hypotheses. Thus, you will be challenged, but your efforts will be more rewarding as you solve the weekly problem.

### **COURSE OBJECTIVES**

The laboratory course is designed to meet a number of specific objectives. They are as follows:

#### ***Understanding Scientific Methodology***

1. Students will understand that science is an objective process that allows them to distinguish between adequate and inadequate explanations of natural phenomena.
2. Students will be able to perform a complete scientific investigation of an appropriate, testable, and measurable phenomenon of interest.
3. Students will be able to apply the appropriate quantitative techniques to a data set such as graphical analysis, algebraic and dimensional analysis, and statistical testing, and correctly interpreting the result.

## *Content Specific Objectives*

All laboratory exercises will be centered on the theme of energy and specifically the influence of the First (energy is neither created nor destroyed) and Second (energy conversions have a natural direction and inefficiency) Laws of Thermodynamics on the disciplines of Physics, Chemistry, and Biology. As a result, students will have an understanding of how these laws apply to the following topics:

Physics:                   Laws of Motion: The Simple Pendulum  
                                Potential and Kinetic Energy: The Inclined Plane  
                                The Earth's Climate System

Chemistry:                Atomic Spectra  
                                Rates of Chemical Reaction  
                                Endergonic and Exergonic Reactions

Biology:                   Cellular Respiration and Photosynthesis  
                                Energy Flow in Ecosystems

Consult your lab manual for specific weekly objectives.

## **RELATIONSHIP TO CURRICULAR GOALS**

The content of the lab course has been developed to meet the goals of the Clare College Curriculum as adopted by the Faculty Senate. Inquiry in the Natural World formally addresses Core Goal I: To promote an understanding of the major achievements and the modes of inquiry that have contributed to the intellectual and aesthetic development of Western culture. For more information about Clare College and its core area objectives consult the Clare College website at [www.sbu.edu/go/academics/clare-college](http://www.sbu.edu/go/academics/clare-college).

## **LABORATORY INSTRUCTORS**

Dr. Julie Hens	221 De La Roche	375-2480	<a href="mailto:jhens@sbu.edu">jhens@sbu.edu</a>
Dr. Jerry Kiefer	21 De La Roche	375-2671	<a href="mailto:jkiefer@sbu.edu">jkiefer@sbu.edu</a>
Dr. David Levine	103 De La Roche	375-2598	<a href="mailto:dlevine@cs.sbu.edu">dlevine@cs.sbu.edu</a>
Dr. David Manke	303 De La Roche	375-2663	<a href="mailto:dmanke@sbu.edu">dmanke@sbu.edu</a>
Prof. Kevin Vogel	106 De La Roche	375-2558	<a href="mailto:kvogel@sbu.edu">kvogel@sbu.edu</a>

All instructors have regularly scheduled office hours that will be posted and announced in class. If you are not available during any of your instructor's scheduled office hours, please make an appointment for another time.

Since Clrl 102 and Clar 102 are separate courses, your instructors may not have knowledge of the other course. Please consult your lab instructor only with regard to lab related questions and your lecture instructor only for lecture related inquiries.

## REQUIRED MATERIALS

During the second week of the semester, you will receive a lab manual. This manual will contain all of the introductory materials to be studied **prior** to class including any preliminary assignments; the laboratory exercises themselves will be handed out at the beginning of each class. The charge for the lab manual is included in the \$50 course fee which will be billed directly by the Bursar's Office.

Students are expected to bring **pencils and calculators** to laboratory every week. You will not be allowed to use your cell phone calculator for in-class quizzes and the final exam. For Clare 102, an inexpensive calculator that is able to perform routine functions and hold a large number of decimal places will suffice.

Limited materials are available for use outside of the lab for independent projects. If students wish to sign out lab materials, a **refundable ten dollar deposit** will be collected.

## SCHEDULE OF TOPICS AND ATTENDANCE POLICY

The tentative schedule of topics on the last page lists what will be covered in lab each week. Cross attending of laboratory sections is prohibited.

Because much of the work in laboratory is performed by groups and not by individuals, attendance in laboratory is critical. The exercises are specifically designed to be performed by teams; an individual cannot be expected to do all of the work within the allocated time! When you miss a class, you place an additional burden on your lab partners. Be fair to your classmates and make every effort to attend class (see peer evaluation system under grading below).

There will be **NO** make-up labs. You will, however, be given **ONE** opportunity to atone for a missed class by writing a paper on an approved topic. You must contact your instructor within **48 hours of missing class** and indicate that you wish to exercise this option. These papers will be due **two weeks** after the instructor has assigned it. The maximum grade on these papers will not exceed the group score for that week by more than five points. Failure to turn in the paper on time or subsequent absences from laboratory will result in a zero for that week (*a loss of approximately six percent from your course grade*). **This option cannot be used as a substitute for the last lab exercise.**

**Expect the class to last the full two hours.** Depending on how efficiently your group attacks the weekly exercise, individual sessions may end early or run overtime. It is advised that you do not schedule another class or other commitments within a half hour of your appointed end time. Special dispensations will not be made to accommodate schedule conflicts.

Students with disabilities who believe they may need accommodations in this class are encouraged to contact the Disability Support Services Office (26 Doyle, 375-2065) as soon as possible to ensure that such accommodations are implemented in a timely manner. Documentation from this office is required before accommodations can be made.

## GRADING

### Weekly Evaluation and Final Exam (75%)

The bulk of the course grade will be determined by the evaluation of weekly assignments. These assignments will include: preparatory homework, quizzes, and in-class lab reports.

#### *Preliminary Assignments*

In order to maximize your success in the course, it is essential that you come to lab prepared. Adequate preparation will require you to study the introductory material in the lab manual and, when assigned, complete the written assignment at the end of each reading. There are two copies of the assignment so that you can hand one in to your instructor and *use the other copy for reference during class*.

Your instructor will collect these assignments and may also, as a substitute or in addition, give an entrance quiz on the reading/written assignment. You are guaranteed a *minimum of five* quizzes/prelab collections; the *average* of these scores will count as the *equivalent* of an *in-class lab report*. If you are late to class, your preliminary assignment will not be collected.

It will be assumed that you understand the introductory materials when you come to class. If you are having difficulties, please consult your instructor *in advance*.

#### *In-Class Lab Reports*

Your group will be given an in-class assignment each week. These assignments are due at the end of the class period. Under no circumstances will your group be allowed to take the assignment out of class and hand it in at a later time. Therefore, if your schedule allows, it is advised that you arrive early and preview the lab. Classes will begin on schedule and tardiness will not be tolerated (see section on Student Conduct)

Each in-class assignment will be weighted equally and your level of success on one assignment does not predict or prevent success on any future assignments.

#### *Final Exam*

During the final exam period (see class schedule on the last page for specific date, time, and location), you will be given a *cumulative* final exam. This exam will be counted as the equivalent of *two weekly laboratory assignments* and will be calculated into the weekly evaluation portion of your course grade. As such, the final exam will account for approximately 12 percent of your course grade.

You have the option of dropping the lowest *in-class lab* score (DOES NOT apply to your preliminary assignment average or to zeros accrued from absences, regardless of their nature). Refer to the above attendance policy). If you exercise this option, the lab final

will count as *three* scores. Your option choice must be submitted *in writing* during the last lab session. There are no make up options for the final exam itself.

### **Scientific Investigation (25%)**

Each lab group will conduct an independent scientific investigation, culminating in an oral presentation of results to the class and the writing of a group scientific paper. *In order to receive a passing grade for the course, all students must actively participate in an oral presentation and the final laboratory report must receive a satisfactory score (60%).* Individual lab groups will choose the investigation topics in consultation with the laboratory instructor. This project will fulfill several of the course objectives outlined above including the use of statistical testing to evaluate data.

### **Peer Evaluation**

Each individual (anonymously) will rate all of the other members of their group at the end of the course. Individual peer evaluation scores will be the average of the points they receive from the members of their group. These evaluations will be used to adjust the score of the *scientific investigation project* only. If an individual receives on average a 90% on the peer evaluations, the individual will receive 90% of his or her score on the scientific investigation project. *All students must receive at least 60% in the peer evaluation to pass the course.* Scores below 60% clearly indicate that you have shirked your responsibility. However, instructors reserve the right to overrule the peer evaluation score if it appears there is a miscarriage of justice.

### **Grade Calculation**

Your course grade will be determined using the following grade scheme:

>93%	A	73-76.9%	C
90-92.9	A-	70-72.9%	C-
87-89.9	B+	67-69.9%	D+
83-86.9%	B	63-66.9%	D
80-82.9%	B-	60-62.9%	D-
77-79.9%	C+	< 60%	F

### **IMPORTANT DATES FOR THE SEMESTER**

*Inquiry in the Natural World* will follow the published schedule with regard to adding and dropping the course. Below are the important dates:

**Monday, January 21** Last day for schedule changes without academic penalty

**Friday, March 28** Last day to withdraw from courses

No student will be allowed to drop the course after the November 1 deadline except for severe and extenuating circumstances. These petitions must be approved by your lab instructor, the Dean of Clare College, and the dean for the student's major field.

## **CODE OF CONDUCT**

Remember, all policies outlined in this syllabus are in addition to those regarding academic dishonesty specified in the student handbook (pp 51-57). Some of the more common infractions of the dishonesty policy encountered in this course include **giving or receiving information during quizzes and exams, communication with other teams during laboratory, and plagiarism on written assignments.**

Academic dishonesty is inconsistent with the moral character expected of students in a University committed to the spiritual and intellectual growth of the whole person. It also subverts the academic process by distorting all measurements. It is a serious matter and will be dealt with accordingly. The first breach of the policy will result in a zero for that assignment. A subsequent offense will result in a failure for the course.

**Students must be in attendance for the entire duration of class. You will not be given credit for an exercise if you arrive more than 15 minutes late or leave more than 15 minutes early.**

Cell phones must be turned off during class. Even the most unobtrusive ring (i.e., vibrate) is a distraction. If your phone rings during class, or you check for voice mail, or you send text messages, **you will be asked to leave and will not receive credit for that day.** If you have an emergency situation that may require your immediate attention, please advise your instructor before class begins.

## TENTATIVE SEMESTER SCHEDULE

<b>Week of January 14</b>	<b>Introduction, Skills Exercise</b>
<b>Week of January 21</b>	<b>The Simple Pendulum</b>
<b>Week of January 28</b>	<b>Introduction to Scientific Investigation</b>
<b>Week of February 4</b>	<b>NO LAB</b> <b>Students Work on Group Projects</b>
<b>Week of February 11</b>	<b>The Inclined Plane</b> <b>(t-test analysis due Thursday, February 14)</b>
<b>Week of February 18</b>	<b>Atomic Spectra</b> <b>(Quiz on t-test analysis)</b>
<b>Week of February 25</b>	<b>NO LAB</b> <b>(Midterm Break)</b>
<b>Week of March 3</b>	<b>Rates of Chemical Reactions</b>
<b>Week of March 10</b>	<b>Endergonic and Exergonic Reactions</b>
<b>Week of March 17</b>	<b>Photosynthesis and Respiration</b> ⌘ <b>(Monday, Tuesday, and Wednesday Classes)</b>
<b>Week of March 24</b>	<b>Photosynthesis and Respiration</b> ⌘ <b>(Thursday Classes Only)</b> <b>(Regression Analysis Due, Thursday, March 27)</b>
<b>Week of March 31</b>	<b>Energy Flow Through Ecosystems</b>
<b>Week of April 7</b>	<b>Presentation of Scientific Investigation</b>
<b>Week of April 14</b>	<b>Climate Modeling</b> ⌘ <b>(Group Lab Reports Due Thursday, April 17)</b>
<b>Week of April 21</b>	<b>Maximizing Energy Efficiency</b>
<b>Friday, May 2</b>	<b>Final Exam (3:45 PM, Murphy Auditorium) #</b>

⌘ Indicates the exercise is computer-based and will be held in DeLaRoche 22

# We have made special arrangements to schedule the exam during an open time period. If you have a conflict with this time, you must discuss the conflict with your instructor during the first two weeks of class (by Friday, January 25).