

# **Physical Science 110A**

## **Course Syllabus**

**Fall Semester 2009**

**Professor: Lawrence Rees**

### **Contents:**

Course Description and Outline, including  
Schedule for lectures and labs  
Homework Assignments  
6 Lab Report cover sheets (yellow)  
6 Homework cover sheets (pink)

**Physical Science 110A**  
**Course Description and Outline**  
**Fall Semester 2009**

This syllabus will be your guide for the course. It contains a description of the course, aids which are provided for your use, details of organization, information about grading and scheduling, and other items which will help you in your study. Contained near the end of this syllabus is the schedule for the semester and the homework assignments. We will give you six laboratory report cover sheets (yellow), and six homework cover sheets (pink).

PLEASE READ THIS ENTIRE SYLLABUS THOROUGHLY. YOU WILL NEED THE INFORMATION CONTAINED IN IT IF YOU ARE TO BE SUCCESSFUL IN THE COURSE.

INSTRUCTORS

Professor: Lawrence Rees

N357 ESC, 422-4307.

Office hours: T,Th 2:00 – 4:00 p.m. am and by appointment

Email: Lawrence\_Rees@byu.edu

Teaching assistants: in laboratory room, C251 ESC, 422-9288

COURSE OBJECTIVES

The basic aim of this course is to teach you the foundational principles of physical science so that you can 1) better understand the world around you, 2) better appreciate the beauty and symmetry of natural law, and 3) better teach elementary school children physical science principles and the scientific approach to analyzing information and solving problems.

More specifically, if you successfully finish the course, you will:

- 1) be able to explain the meaning of basics concepts of physics and chemistry.
- 2) see applications of physical science in the world around you.
- 3) be able to read and understand non-technical scientific literature about topics in physics and chemistry.
- 4) be able to evaluate arguments about public issues that involve topics in this course.
- 5) be able to teach scientific ideas using an inquiry-based approach.
- 6) have a repertoire of simple experiments using ordinary materials and equipment that you can use to teach basic principles and develop scientific inquisitiveness.

These goals are accomplished through homework problems that relate to science in everyday life, inquiry-based lectures, group discussions that emphasizing teaching ideas, test questions that relate to science in the news, and labs that make science a hands-on experience.

Although Physical Science 110A is a course for elementary school teachers, the course will give you a much greater breadth and depth than is necessary for elementary education. We will concentrate on teaching you science; however, we will discuss a few topics from physics education research and discuss topics in Utah State Science Core in a little greater depth.

Our treatment is conceptual, not heavily oriented to mathematical problem solving. The important ideas are accessible to you *no matter what your previous experience in mathematics or science* may have been. They are not trivial, however. The ideas you will study have been selected from among the most profound ideas ever discovered and understood. They have had enormous impact on our culture, our history, even on the ways we think. Serious study will be required if you are to master them.

### TEXT AND LAB MANUAL

Our required text is *Physical Science Foundations, 2.5<sup>th</sup> Edition*, by Brigham Young University College of Physical and Mathematical Sciences. This is also the Physical Science 100 text. We will study chapters 1-23, 25 and 34.

Our laboratory manual is *Ideas and Experiments in Physical Science, 2<sup>nd</sup> Edition*, by B.K. Harrison. It is really more of a supplement than a lab manual as it contains notes for each chapter, review questions, sample tests, and additional course material (particularly in astronomy). It also contains the experiments you will do for the laboratory part of the course. This material will be useful for you in your own teaching.

### CLASSES

The class will meet Tuesdays and Thursdays from 9:00 to 10:15 a.m., in C215 of the Eyring Science Center. Roll will not usually be taken, but you are expected to attend class. Missing class costs you points on quizzes and practice points. Questions are encouraged during the lecture period. Most lectures will feature demonstrations which illustrate the operation of the principles discussed.

### COURSE WEB PAGE

The course home page is <http://www.physics.byu.edu/faculty/rees/110>. (You can also access the course from the physics department homepage by going to <http://www.physics.byu.edu>, then click on the link labeled “Courses”, then “Class Web Pages”, and then select “Physical Science 110A”.) All the material in this syllabus, as well as other information and helpful links, is available on the course website. We will often post announcements concerning the course there, so go to this course page often, check your grades there, and make sure all data is correctly entered. Be especially careful on these entries as we approach the end of the semester. If they are not accurately entered your final grade will be affected.

### TEACHING ASSISTANCE

The teaching assistants are former PS110A students. Besides being lab assistants, they are also available in the laboratory for consultation about homework, concepts discussed in the course, and upcoming exams. During your laboratory period, the TAs will discuss particularly difficult homework problems. TAs will be available during most daytime hours Monday through Friday. Schedules will be posted early in the semester. Special times will be posted for Reading days and Final Exam days. The laboratory phone number is 422-9288.

The course instructor will be available in his office during office hours or you can make appointments to meet with him at other times.

You may appeal homework or lab scoring by going to the PS110A TAs. If you feel justice has not been done,

then discuss the matter with the instructor. We do want you to succeed and will help you as much as we can!

### GE REQUIREMENTS IN PHYSICAL SCIENCE

Students may earn their Physical Science GE credit in the Liberal Arts Core (1) by successfully completing both Physical Science 110A and 110B, or (2) by successfully completing Physical Science 100 or Honors 259, or (3) by passing the appropriate competency exam. Passing the competency exam is certainly the quickest way, if you are prepared and feel qualified to take it.

### PREREQUISITES

Students should have the basic reading, writing, and mathematical skills required to enter the University. In particular, no previous college level science or math courses are required for success in this course.

### REGISTRATION

This course is designed for majors in elementary education or early childhood education, but other students may take it. Physical Science 110A covers nearly all the physics, chemistry, and astronomy that is presented in Physical Science 100, but covers it more extensively and adds a lab experience, in order to help prepare you to teach science. If students take this course instead of Physical Science 100, they should also take Physical Science 110B in order to fill the general education requirements.

### CLASS IDENTIFICATION NUMBER

Each of you will receive a personal class identification number (CID) for this course. The purpose of this number is to protect your privacy. **You must put this CID number on all quizzes, homework assignments, laboratory reports and exams, in order to receive credit for you work.** The quizzes, homework, etc., will be returned to you in the Lab room, C251 ESC, sorted by your CID number. If you were registered in the class before the first day of classes your CID number will have been emailed to you. If you were not registered at the beginning of the semester or have not received your identification number by the first day of class, you can obtain it by sending an email to Dr. Rees at lawence\_Rees@byu.edu.

### READING QUIZZES

Reading assignments are indicated in the Course Schedule. **You should read the lecture material before coming to class, and we will assume you have done so.** Reading will prepare you for the lecture and practice activities. At the beginning of each class period, you will be asked to respond to questions on the reading assignment for extra credit.

### CLASS PARTICIPATION

In addition to reading-quiz points you may also earn extra credit practice points. Participation in both the reading quizzes and the practice exercises will make a difference in your grade in two ways: you'll do better on the exams and homework, and you will receive extra credit points. The extra credit points can add as much as 3% to your grade. For the practice points you will be asked to discuss with a class partner a practice question or problem. Reading quizzes are 3 points if correct, 1 if incorrect (credit for participation). Practice questions are

3 points if correct, 2 if incorrect. Answers will be submitted and grades recorded by iClicker.

### HOMWORK ASSIGNMENTS

To help you understand the basic ideas of this course, certain questions from the text are assigned, which you must answer in writing and submit as homework. The list is given at the end of this syllabus. Answer the questions carefully; **they will be graded both on content and on composition, grammar, and spelling.**

Since the purpose of the homework questions is to help you understand the ideas of the course, you may wish to read the questions over before you read the text material, then answer them as you read. The text provides hints which can help you find answers to the questions. You are encouraged to discuss assignments with others, but the homework submitted **must be in your own words. Answers copied from the text and/or other student's work are considered plagiarism and a violation of the Honor Code by all involved.**

Staple your answers to a completed pink homework cover sheet (six are included in this syllabus). Make sure that your CID number is written on the cover sheet. **Homework for a particular chapter is always due at the beginning of class (9:00 a.m.), on the class day following the lecture on the chapter**--that is, on Thursday following a Tuesday lecture over chapter material and on the Tuesday following a Thursday lecture over chapter material. You may leave early homework in the appropriate box in the laboratory room, C251 ESC. Occasionally, homework that is late because of unusual circumstances may be given full credit, but **you must obtain approval from the course professor prior to submitting late homework for it to be considered for credit.** Homework is returned to you in laboratory.

### LABORATORY

The laboratory is an important part of the class. Your particular lab session time is determined by the course section for which you are registered. The laboratory is in C251 ESC. It will be open most hours of the day Monday through Friday. The schedule for doing the assigned labs during the term is included in the course schedule at the end of this syllabus. **PLEASE STICK TO YOUR SCHEDULED LABORATORY TIME. DO NOT ATTEND OTHER LABS** (except in cases of emergency). The instructions for each laboratory (except for Laboratories 0, 11 and 12) are included in the lab manual/supplement (*Ideas and Experiments in Physical Scienc, e2<sup>nd</sup> Edition*, by B.K. Harrison).

The experimental work done in the laboratory may occasionally appear elementary, but it is designed to illustrate principles discussed in class. It is important to have "hands-on" experience in understanding the way nature works -- and sometimes nature surprises us! It is expected that the reports you do will provide you with material for your science file in EE 363 and ECE 363 and the reports will help you teach science later.

You must come to laboratory and do the experiments. Roll will be taken. **Reporting any experimental work as if you had done it, when you have not done it, is a violation of the Honor Code.**

You will be expected to do approximately six experiments in each lab, in small groups of students, under the direction of a Teaching Assistant. The experiments use simple materials that are commonly available, so that you can do them later in your own teaching. The requirements and format for each weekly laboratory write-up will be given to you by your TA. Even though you will work with others, **the written reports must be done individually.**

**Laboratory reports are due at the beginning of your next scheduled laboratory period.** Staple them to a yellow lab cover sheet (6 are included in this syllabus) and hand them to your TA at that time, in the laboratory. Under unusual circumstances, late laboratory reports may be given full credit, **but you must obtain the approval of the course professor prior to submitting the late report for it to be considered for credit.**

Laboratory 0 is an introduction to the laboratory work.

Laboratory 11 involves one home experiment and four astronomical observing projects. These may be done at any time; the report is due near the end of the semester. The assigned work is described in the lab manual. **WARNING!** We often have cloudy weather that makes viewing impossible. Do not leave this laboratory to the end of the semester, or you may be unable to complete it. Note in particular that one project takes **TWO WEEKS**; you may wish to begin shortly after the new moon on September 18.

Laboratory 12 At the end of the semester you will be asked to resubmit all your completed laboratory work collected together, as a portfolio. This will count as Laboratory 12.

### LABORATORY EXTRA CREDIT

You may earn up to nine points extra lab credit, equivalent to one lab assignment, by doing one of the following extra labs: (1) collect information on several experiments which you could use in the classroom, and turn in a report with that information, (2) do experiment 11-6 as described in the lab manual/supplement. Clarification on these labs will be provided for you by your teaching assistant. Normally, no other extra credit projects are allowed.

### EXAMS

There will be three regular exams and a final exam. These are to be taken in the Testing Center during the dates indicated on the class schedule. Review materials and sample exams are provided in the course supplement. Help sessions will be provided for each exam and for the final.

The regular exams will typically have 24 multiple choice questions and three short essay or short answer questions, for a total of 30 points. The final exam – which will be comprehensive – will have 75 multiple choice questions. Your score on the multiple choice questions will be the number of correct responses, with no penalty for incorrect choices.

All exams are closed book and closed notes, with no time limit. You will need only a pencil to take the exams. Supplementary materials (a periodic chart, a list of the chemical elements, etc.) will be provided for Exam #3 and for the Final Exam. A foreign-language dictionary may be used by those for whom English is not a native language. **THE TEST QUESTIONS ARE CONFIDENTIAL AND ARE NOT TO BE DISCUSSED AT ANY TIME WITH ANYONE OTHER THAN THE INSTRUCTOR OR THE TAs.**

No makeup tests are given in this course. You are expected to take the exam when it is offered. If it appears that you will miss a test because of illness or other valid reason, contact the instructor immediately to see if some other arrangement might be made.

### COURSE EXCEPTIONS

Any exceptions to due times and missed assignments, either in class or in the laboratory, must be okayed by the course professor. It is your responsibility to make sure you meet all deadlines and due dates.

### CREDIT AND GRADES

The semester letter grades for Physical Science 110A will be computed by weighting the exams, homework, and lab in four different ways as follows:

homework	20%	10%	15%	5%
laboratory	25%	25%	25%	25%
regular exams (total)	30%	40%	10%	0
final exam	25%	25%	50%	70%

There is extra credit (up to 3%) that can be added to the above evaluation in the form of points from reading quizzes and practice problems. Note that the weight given to the laboratory is the same in each of the four weightings. There is also extra credit that can be earned in the lab. This will just be added to your total lab score and would effectively add up to about another 2%. After everything is submitted, we will use one of the weightings above which gives you the highest percentage to assign letter grades at the end of the semester. During the majority of the semester the grade will be determined by column 1, with a rescaling of percentages to 100% (because your final exam score is not available yet).

The letter grades will be assigned approximately as follows:

A	91% or above
A-	88-91%
B+	85-88%
B	81-85%
B-	77-81%
C+	73-77%
C	69-73%
C-	65-69%
D+	62-65%
D	58-62%
D-	55-58%
E	below 55%

The letter grade "I" (Incomplete) is given on a contractual basis with the instructor. An incomplete is only given when extenuating and unavoidable circumstances (serious illness, death in the immediate family, etc.) occur AFTER the twelfth week of a semester.

Tests, homework, and laboratory scores, and a rough grade to date, will be available online at the course homepage. You may review each exam, comparing your answers to the correct responses, by contacting one of the TAs. This review should be completed before the deadline for the next exam. Tell the TAs or the instructor about any mistakes of online recorded scores.

### ACKNOWLEDGEMENTS

I would like to acknowledge Professors Dorian Hatch, Robert Clark, and Kent Harrison for creating and organizing the course and writing most of this syllabus and other course materials.

## COLLEGE AND UNIVERSITY POLICIES

The College of Physics and Mathematical Sciences suggests that the following statements be included in all course outlines. Please note that I fully endorse these policies.

### **Harassment**

Harassment of any kind is inappropriate at BYU. Specifically, BYU's policy against sexual harassment extends not only to employees of the university but to students as well. If you encounter sexual harassment, gender-based discrimination, or other inappropriate behavior, please talk to your professor, contact the Equal Employment Office at 422-5895 or 367-5689, or contact the Honor Code Office at 422-2847.

### **Disabilities**

BYU is committed to providing reasonable accommodation to qualified persons with disabilities. If you have any disability that may adversely affect your success in this course, please contact the University Accessibility Center at 422-2767. Services deemed appropriate will be coordinated with the student and instructor by that office.

### **Children in the Classroom**

The serious study of the physical and mathematical sciences requires uninterrupted concentration and focus in the classroom. Having small children in class is often a distraction that degrades the educational experience for the entire class. Please make other arrangements for child care rather than bringing children to class with you. If there are extenuating circumstances, please talk with your instructor in advance.

**PHYSICAL SCIENCE 110A COURSE SCHEDULE FALL SEMESTER 2009**

Sep	1 T	Introduction to Physical Science 110A	No Lab	
	3 Th	1. Knowledge, Science and the Universe		
	8 T	2. Laws Governing Motion	Lab 0 (intro)	Sep 7 – 11
	10 Th	3. The Gravitational Interaction		
	15 T	4. The Electromagnetic Interaction	Lab 1	Sep 14 – 18
	17 Th	5. Application of Laws of Force and Motion		
	22 T	6. Forces in Fluids	Lab 2	Sep 21--25
	24 Th	7. Motions at High Speed and ASTRONOMY*		
		*Read Astronomy notes, Harrison SUPPLEMENT pp. 21—27.		
	29 T	8 & 9 Conservation Laws and Energy	Lab 3	Sep 28 – Oct 2
Oct	1 Th	REVIEW OF CHAPTERS 1—9 & ASTRONOMY		
	5-7 M-W	<b>Exam 1 in Testing Center on chapters 1—9 and ASTRONOMY</b>		
		<b>(Must pick up by 4:00 Wednesday, Oct 7)</b>		
	6 T	10. Waves	Lab 4	Oct 5 – 9
	8 Th	11. The Properties of Light		
	13 T	12. Physical Properties of Matter	Lab 5	Oct 12 – 16
	15 Th	13. The Molecular Model of Matter		
	20 T	14. The Nuclear Atom	Lab 6	Oct 19 – 23
	22 Th	15. Duality of Matter		
	27 T	16. The Quantum Model of the Atom	Lab 7	Oct 26 – 30
	29 Th	REVIEW OF CHAPTERS 10-16		
Nov	2-4 M-W	<b>Exam 2 in Testing Center on chapters 10—16</b>		
		<b>(Must pick up by 4:00 Wednesday, Nov 4)</b>		
	3 T	17. The Periodic Table	Lab 8	Nov 2 – 6
	5 Th	18. The Law of Increasing Disorder		
	10 T	19. Atoms, Molecules and Extended....	Lab 9	Nov 9 – 13
	12 Th	20. Principles of Chemical Reactivity		
	17 T	21. Bonding in Metals, Alloys, and...	Lab 10	Nov 16 – 20
	19 Th	22. Bonding in Ionic Compounds	<b>Lab 10 due by 2:00 pm on Nov 23.</b>	
	24 T	<b>Friday Instruction</b>		
Dec	1 T	23. Covalent Bonding and Intermolecular....		
	3 Th	REVIEW OF CHAPTERS 17—23	<b>Lab 11 due by 2:00 pm on Dec 4.</b>	
	7 – 9 M-W	<b>Exam 3 in Testing Center on chapters 17-23</b>		
		<b>(Must pick up by 4:00 Wednesday, Dec 9)</b>		
	8 T	25. Radioactivity, Nuclear....	<b>H.W., Lab 12 (portfolio) &amp; extra credit due by 2:00 p.m., Dec. 10</b>	
	10 Th	34. Cosmology		

**Dec 14-18 (M-F Final Examination in Testing Center)**

**Labs** will be set up as indicated in the above schedule, starting Monday of the given week. However, **LABs** #11, and #12 and extra credit labs, will be **DUE AS SHOWN ABOVE**.

The **Final Exam** will be available in the Testing Center during the entire Final Exam Period. It is not limited in time, but it must be finished by the Testing Center Closing Time.

September 7 is a holiday so regular lab scheduling must be rearranged. Go to another lab during this week if you would normally have lab on Monday.

**PHYSICAL SCIENCE 110A**  
**HOMEWORK ASSIGNMENTS**

<u>CHAPTER</u>	<u>ANALYSIS QUESTIONS</u>	<u>SYNTHESIS QUESTIONS</u>
1.	<b>1:</b> 2, 3, 4, 6	<b>1:</b> 2
2.	<b>2:</b> 1, 5, 9	<b>2:</b> 3, 4, 5
3.	<b>3:</b> 1, 5, 8	<b>3:</b> 2, 3, 4
4.	<b>4:</b> 3, 4, 5	<b>4:</b> 1, 2, 4
5.	.....	<b>5:</b> First Law 2, 4 Second Law 2, 3, 4, 7 Third Law 1, 2
6.	<b>6:</b> 1, 3, 10, 12	<b>6:</b> 2, 5
7. and ASTRONOMY*	<b>7:</b> 1, 2, 3	<b>7:</b> 1, 4
8. and 9.	<b>8:</b> 3, 4 <b>9:</b> 1, 13	<b>8:</b> 1, 2, 4, 6 <b>9:</b> 1, 3
10.	<b>10:</b> 3, 4, 7	<b>10:</b> 1, 7, 9
11.	<b>11:</b> 2, 8, 10	<b>11:</b> 1, 5, 6
12.	<b>12:</b> 1, 2, 4	<b>12:</b> 4, 5, 8
13.	<b>13:</b> 1, 3, 4	<b>13:</b> 2, 4, 6
14.	<b>14:</b> 3, 4, 5, 6	<b>14:</b> 2, 6
15.	<b>15:</b> 1, 4, 5	<b>15:</b> 2, 4, 5
16.	<b>16:</b> 1, 2, 4, 5	<b>16:</b> 1, 5
17.	<b>17:</b> 2, 3, 4	<b>17:</b> 1, 2, 3
18.	<b>18:</b> 3, 8, 10	<b>18:</b> 1, 2, 4
19.	<b>19:</b> 1	<b>19:</b> 1, 6, 8
20.	<b>20:</b> 1, 2, 4	<b>20:</b> 2
21.	<b>21:</b> 1, 2, 4	<b>21:</b> 2, 4, 7
22.	<b>22:</b> 1, 2, 8	<b>22:</b> 1, 5, 6
23.	<b>23:</b> 2, 3	<b>23:</b> 1, 5, 7
25.	<b>25:</b> 1, 2, 3, 5, 6	<b>25:</b> 1