



ARIZONA STATE UNIVERSITY
GENERAL STUDIES COURSE PROPOSAL COVER FORM

Course information:

Copy and paste current course information from Class Search/Course Catalog.

Academic Unit College of Liberal Arts and Sciences Department Department of Physics
 Subject PHS Number 208 Title Patterns in Nature Units: 4

Is this a cross-listed course? No
 If yes, please identify course(s) _____

Is this a shared course? Yes If so, list all academic units offering this course MSE 208

Course description:
 Examines topics from optics to analytical techniques.

Requested designation: Natural Sciences-SQ

Note- a separate proposal is required for each designation requested

Eligibility:

Permanent numbered courses must have completed the university's review and approval process.
 For the rules governing approval of omnibus courses, contact Phyllis.Lucie@asu.edu or Lauren.Leo@asu.edu.

Submission deadlines dates are as follow:

For Fall 2015 Effective Date: October 9, 2014

For Spring 2016 Effective Date: March 19, 2015

Area(s) proposed course will serve:

A single course may be proposed for more than one core or awareness area. A course may satisfy a core area requirement and more than one awareness area requirements concurrently, but may not satisfy requirements in two core areas simultaneously, even if approved for those areas. With departmental consent, an approved General Studies course may be counted toward both the General Studies requirement and the major program of study.

Checklists for general studies designations:

Complete and attach the appropriate checklist

- [Literacy and Critical Inquiry core courses \(L\)](#)
- [Mathematics core courses \(MA\)](#)
- [Computer/statistics/quantitative applications core courses \(CS\)](#)
- [Humanities, Arts and Design core courses \(HU\)](#)
- [Social-Behavioral Sciences core courses \(SB\)](#)
- [Natural Sciences core courses \(SQ/SG\)](#)
- [Cultural Diversity in the United States courses \(C\)](#)
- [Global Awareness courses \(G\)](#)
- [Historical Awareness courses \(H\)](#)

A complete proposal should include:

- Signed General Studies Program Course Proposal Cover Form
- Criteria Checklist for the area
- Course Catalog description
- Course Syllabus
- Copy of Table of Contents from the textbook and list of required readings/books

Respectfully request that proposals are submitted electronically with all files compiled into one PDF. If necessary, a hard copy of the proposal will be accepted.

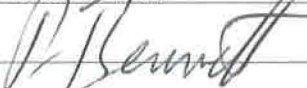
Contact information:

Name Alicia Hawley Phone 480-965-6794

Mail code 1504 E-mail: alicia.hawley@asu.edu

Department Chair/Director approval: (Required)

Chair/Director name (Typed): Dr. Peter Bennett Date: 3/20/2015

Chair/Director (Signature): 

Arizona State University Criteria Checklist for

NATURAL SCIENCES [SQ/SG]

Rationale and Objectives

Public scientific literacy, critical for sound decisions on scientifically infused issues such as climate change, includes understanding of basic science concepts, such as the fundamental behavior of matter and energy. It also includes the understanding that "science" is not an encyclopedic collection of facts. Rather, it is a process of exploration that embraces curiosity, inquiry, testing, and communication, to reduce uncertainty about nature. Absent understanding of scientific concepts and of the nature of science, science and pseudoscience are difficult to distinguish, and normal scientific disagreements may be misinterpreted as ideological or political disputes. The goal of the natural sciences (SQ/SG) requirement, including the laboratory requirement, is to instill understanding of basic science content and of the nature of science in every ASU graduate.

10/1989

REV: 1/1991, 3/1991, 1/2000, 10/2008, 4/2014

Proposer: Please complete the following sections and attach appropriate documentation.

ASU--[SQ] CRITERIA			
I. - FOR ALL <i>QUANTITATIVE</i> [SQ] NATURAL SCIENCES CORE AREA COURSES, THE FOLLOWING ARE CRITICAL CRITERIA AND MUST BE MET:			
YES	NO		Identify Documentation Submitted
<input checked="" type="checkbox"/>	<input type="checkbox"/>	A. Course emphasizes the mastery of basic scientific principles and concepts.	Syllabus
<input checked="" type="checkbox"/>	<input type="checkbox"/>	B. Addresses knowledge of scientific method.	Syllabus
<input checked="" type="checkbox"/>	<input type="checkbox"/>	C. Includes coverage of the methods of scientific inquiry that characterize the particular discipline.	Syllabus
<input checked="" type="checkbox"/>	<input type="checkbox"/>	D. Addresses potential for uncertainty in scientific inquiry.	Syllabus
<input checked="" type="checkbox"/>	<input type="checkbox"/>	E. Illustrates the usefulness of mathematics in scientific description and reasoning.	Syllabus
<input checked="" type="checkbox"/>	<input type="checkbox"/>	F. Includes weekly laboratory and/or field sessions that provide hands-on exposure to scientific phenomena and methodology in the discipline, and enhance the learning of course material.	Syllabus
<input checked="" type="checkbox"/>	<input type="checkbox"/>	G. Students submit written reports of laboratory experiments for constructive evaluation by the instructor.	Syllabus
<input checked="" type="checkbox"/>	<input type="checkbox"/>	H. Course is general or introductory in nature, ordinarily at lower-division level; not a course with great depth or specificity.	Syllabus
II. - AT LEAST ONE OF THE FOLLOWING ADDITIONAL CRITERIA MUST BE MET WITHIN THE CONTEXT OF THE COURSE:			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	A. Stresses understanding of the nature of basic scientific issues.	Syllabus
<input type="checkbox"/>	<input type="checkbox"/>	B. Develops appreciation of the scope and reality of limitations in scientific capabilities.	
<input type="checkbox"/>	<input type="checkbox"/>	C. Discusses costs (time, human, financial) and risks of scientific inquiry.	
NOTE: CRITERIA FOR [SG] COURSES BEGIN ON PAGE 4.			

III. - [SQ] COURSES MUST ALSO MEET THESE ADDITIONAL CRITERIA:			
YES	NO		Identify Documentation Submitted
<input checked="" type="checkbox"/>	<input type="checkbox"/>	A. Provides a substantial, quantitative introduction to fundamental principles governing behavior of matter and energy, in physical or biological systems.	Syllabus
		B. Includes a college-level treatment of some of the following topics (check all that apply below):	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	a. Atomic and molecular structure	Syllabus
<input type="checkbox"/>	<input type="checkbox"/>	b. Electrical processes	
<input type="checkbox"/>	<input type="checkbox"/>	c. Chemical processes	
<input type="checkbox"/>	<input type="checkbox"/>	d. Elementary thermodynamics	
<input type="checkbox"/>	<input type="checkbox"/>	e. Electromagnetics	
<input type="checkbox"/>	<input type="checkbox"/>	f. Dynamics and mechanics	
[SQ] REQUIREMENTS CANNOT BE MET BY COURSES:			
<ul style="list-style-type: none"> • Presenting a qualitative survey of a discipline. • Focusing on the impact of science on social, economic, or environmental issues. • Focusing on a specific or limiting but in-depth theme suitable for upper-division majors. 			

Proposer: Please complete the following section and attach appropriate documentation.

ASU--[SG] CRITERIA			
I. - FOR ALL <i>GENERAL</i> [SG] NATURAL SCIENCES CORE AREA COURSES, THE FOLLOWING ARE CRITICAL CRITERIA AND MUST BE MET:			
YES	NO		Identify Documentation Submitted
<input type="checkbox"/>	<input type="checkbox"/>	1. Course emphasizes the mastery of basic scientific principles and concepts.	
<input type="checkbox"/>	<input type="checkbox"/>	2. Addresses knowledge of scientific method.	
<input type="checkbox"/>	<input type="checkbox"/>	3. Includes coverage of the methods of scientific inquiry that characterize the particular discipline.	
<input type="checkbox"/>	<input type="checkbox"/>	4. Addresses potential for uncertainty in scientific inquiry.	
<input type="checkbox"/>	<input type="checkbox"/>	5. Illustrates the usefulness of mathematics in scientific description and reasoning.	
<input type="checkbox"/>	<input type="checkbox"/>	6. Includes weekly laboratory and/or field sessions that provide hands-on exposure to scientific phenomena and methodology in the discipline, and enhance the learning of course material.	
<input type="checkbox"/>	<input type="checkbox"/>	7. Students submit written reports of laboratory experiments for constructive evaluation by the instructor.	
<input type="checkbox"/>	<input type="checkbox"/>	8. Course is general or introductory in nature, ordinarily at lower-division level; not a course with great depth or specificity.	
II. - AT LEAST ONE OF THE ADDITIONAL CRITERIA THAT MUST BE MET WITHIN THE CONTEXT OF THE COURSE:			
<input type="checkbox"/>	<input type="checkbox"/>	A. Stresses understanding of the nature of basic scientific issues.	
<input type="checkbox"/>	<input type="checkbox"/>	B. Develops appreciation of the scope and reality of limitations in scientific capabilities.	
<input type="checkbox"/>	<input type="checkbox"/>	C. Discusses costs (time, human, financial) and risks of scientific inquiry.	

[SG] REQUIREMENTS CANNOT BE MET BY COURSES:		
	<ul style="list-style-type: none">• Presenting a qualitative survey of a discipline.	
	<ul style="list-style-type: none">• Focusing on the impact of science on social, economic or environmental issues.	
	<ul style="list-style-type: none">• Focusing on a specific or limiting but in-depth theme suitable for upper-division majors.	

Course Prefix	Number	Title	General Studies Designation
PHS	208	Patterns in Nature	SQ

Explain in detail which student activities correspond to the **specific** designation criteria. Please use the following organizer to explain how the criteria are being met.

Criteria (from checksheet)	How course meets spirit (contextualize specific examples in next column)	Please provide detailed evidence of how course meets criteria (i.e., where in syllabus)
I.A	Students must read and understand concepts before undertaking specific assignments	All assigned activities have this objective, e.g., read about geometrical optics and then measure lens focal length.
I.F	Students must complete assigned activities on a weekly basis	Specified in syllabus . Students must also attend two on-campus laboratory sessions and complete assigned practical activities.
I.G	Submission of reports after completion of on-campus activities is a specified task for all students taking the class.	Specified in syllabus. Students must perform specific tasks and submit reports summarizing their results.
II.A	Stressed throughout the class, and enhanced by completion on in-home and on-campus activities	Specified in syllabus. Students must perform specific tasks and submit reports summarizing their results.

Allcia Hawley

- my class schedule
- class search
- add
- drop/withdraw
- swap
- edit
- schedule planner

New! The Schedule Planner.

Easily generate a class schedule based on your criteria.

course catalog & class search

Click on the title of the course for more details. Each column can be sorted by clicking on the column header. Courses found: 1

Collect

Term:

Search:

Subject: Num:

Level:

Gen Studies:

Keywords:

Offerings:

Search

Clear

Advanced Search

Course	Title	Units	General Studies
PHS 208	Patterns In Nature Examines topics from optics to analytical techniques. Allow multiple enrollments: No Primary course component: Lecture Repeatable for credit: No Grading method: Student Option Offered by: College of Liberal Arts and Sciences -- Department of Physics Credit is allowed for only MSE 208 or PHS 208	4	SQ

Alicia Hawley

- my class schedule
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course catalog & class search

Term:

Search:

Subject:

Level:

Gen Studies:

Keywords:

Offerings:

Search

[Clear](#)
[Advanced Search](#)

PHS 208 - Patterns in Nature

Spring

Course description: Examines topics from optics to analytical techniques.

Enrollment requirements: Credit is allowed for only MSE 208 or PHS 208

Units: 4

Repeatable for credit: No

General Studies: SQ

Offered by: [College of Liberal Arts and Sciences](#)

Class meeting details

Class #:	Days:	Start:	End:	Location:	Instructor:	Seats open:
10605		12:00 AM	12:00 AM	Tempe - TBA Tempe - TBA	Mayer, Smith	0 of 200 <input type="button" value="Add"/>

Additional class details

Component: Lecture

Session: Session C

Dates: 1/12/2015 - 5/1/2015

Instruction Mode: Hybrid

Hybrid fee: \$50

Fees: \$50 course fee

Combined with: [MSE 208 \(11790\)](#)

Books:



[View books for this class](#)



[Back](#)

PATTERNSin**nature**
Syllabus

PHS 208 / MSE 208: Patterns in Nature

Credit Hours: 4

Course Description

Project-oriented science course to develop critical thinking, and technical skills. This course is concerned with light and microscopy at the conceptual level. A healthy love and curiosity for understanding the workings of the universe is essential to get the most out of your experience. Each week there are readings, activities, and exercises dealing with a particular concept (or two) in light, optics, or microscopy.

Textbooks

There are no required written textbooks for the course, since all the readings are online. However, a **Lab Manual** must be purchased. (Bring this with you to Both Labs - the activities in it will be completed in Lab). This can be purchased at the ASU Tempe Campus Bookstore (<http://bookstore.asu.edu/index.php>).

* Patterns of Light: Chasing the Spectrum, by Steven Beeson and James Mayer is a highly recommended resource for this course that is available at the ASU bookstore

An **Optics Kit** is necessary to complete some of the Weekly Activities. This will be handed out during Lab 1. If you miss Lab 1 please contact Frank.Mayer@asu.edu to make arrangements for obtaining your Optics Kit.

Course Coordinators

Frank Mayer
David J. Smith

e-mail: frank.mayer@asu.edu david.smith@asu.edu

Office: Physical Science H566

Address: Department of Physics, Arizona State University, Tempe, AZ 85287-1504

Course Consultants

Elizabeth Mayer
email: ebm@asu.edu

Schedule for Spring 2015

MSE 208, PHS 208 (4 credits)
 Internet Course

Please be aware that this is a **preliminary schedule**. The schedule may be updated throughout the semester.

Week	Topic	Home Activity	Readings	Exercise
1 12 Jan	Path of Light	Pinhole Scope	Path of Light Pinhole Scope	Exercise 1
2 19 Jan	Reflection Refraction	Mirrors The Bent Pencil	Reflection of Light Refraction of Light	Exercise 2
2* 20 Jan	Tuesday Lab	Lab One	PHS 563	See Syllabus
2* 21 Jan	Wednesday Lab	Lab One	PHS 563	See Syllabus
2* 22 Jan	Thursday Lab	Lab One	PHS 563	See Syllabus
2* 23 Jan	Friday Lab	Lab One	PHS 563	See Syllabus
3 26 Jan	Lenses Fresnel Lenses	Lenses Fresnel Lenses	Lenses & Geometrical Optics Fresnel Lenses	Exercise 3
4 2 Feb	Life Cycle of Photon	The Photon	Life Cycle of Photon	Exercise 4
4 8 Feb	Lab Report # 1 is Due 8 Feb			
5 9 Feb	Color and the Visible Spectrum	The Spectrum	Color & Light Sources of Light Composition of Color	Exercise 5 EXAM 1
6 16 Feb	Rainbows & Blue Sky	What Causes <u>Rainbows?</u> Why is the Sky Blue?	Rainbows Blue Sky & White Clouds	Exercise 6
7 23 Feb	Interference Colors	Why are Bubbles so Colorful?	Color, Thin Film & Inter- ference	Exercise 7
8 2 Mar	Color Composition and Polarized Light	Color and Polarized Light	Color and Light Polarized Light	Exercise 8

8* 2 Mar	Monday Lab	Lab Two	PHS 563	See Syllabus
8* 3 Mar	Tuesday Lab	Lab Two	PHS 563	See Syllabus
8* 4 Mar	Wednesday Lab	Lab Two	PHS 563	See Syllabus
8* 5 Mar	Thursday Lab	Lab Two	PHS 563	See Syllabus
9 Mar	SPRING BREAK - NO CLASSES 9 - 13 March			
9 16 Mar	Optical Spectroscopy, Neon Lights	Performed in Friday/Saturday Lab	Optical Spectroscopy and Neon Lights	Exercise 9
10 23 Mar	Electrons in Atoms	Electrons in Atoms	The Electron Electrons in Atoms	Exercise 10 EXAM 2
11 30 Mar	Visible Light, IR, X-rays and UV	X-rays and UV	Visible Light and X-Rays; Infrared and <u>Ultraviolet</u> <u>Light</u> ; X-Radiography	Exercise 11
11 5 Apr	Lab Report # 2 is Due 5 April			
12 6 Apr	Optical Microscopy	Optical Microscopy	Optical Microscopy	Exercise 12
12* 10 Apr	LAB MAKE-UP	LAB MAKE UP	PHS 563	To Be Announced
12 12 Apr	Research Paper is Due 12 April			
13 13 Apr	Electron Microscopy	Images of Nature	Optical vs. Electron Microsc	Exercise 13
14 20 Apr	Analysis of Mars and Air	PIXE - Particle Induced X-Ray Emission	X-Ray Emission: Earth, Moon, & Mars	Exercise 14 EXAM 3
* Students must attend LAB ONE AND TWO sessions. Please plan to attend both sessions. Make-up lab sessions are by permission only.				

Student Responsibilities

Checking In

Each concept builds on the previous weeks' topics, so students should expect to stay current in each week's readings and activities. Students should also check their email and the Announcements page every weekday and weekends.

Activities

The [activities](#) are carried out at home using (usually) everyday household items or objects from the [Optics Kit](#) that you'll be receiving (see [Welcome](#) page). Along with each activity is an Activity Reply on the Web site that you should complete and submit by midnight Sunday of that week.

Readings

Supplementing the Activities and forming the foundation for the content of the course are the [Readings](#). At least one reading is assigned for each week/concept. All of the readings are located on the Patterns Web site and can be printed out for hardcopy use. If you do decide to print out copies of the readings, please make sure you have set the page and printer settings correctly to print out the entire width of the page and all of the images. *As an internet course, sometimes additional internet searches of the various topics will be necessary to assist the student in understanding the material for the week's assignments.

Exercises

A short exercise based on the current concept and readings will be assigned each week to be due on Sunday at midnight. We have set up the exercise pages to be graded automatically and instantaneously by the Web server. In order for this procedure to work correctly, you should be running either at least [Netscape Navigator 4.0](#) or [Microsoft Internet Explorer 4.0](#) as your Web browser. Please do not try to access the exercises or exams on a America On-Line browser. All of the assessment for the Patterns course will be completed in the Assignments section of the site. Late submissions (less than one week past due) will be marked 50% off the graded score.

Submissions more than one week late will get zero credit.

On Campus Labs

Because some of the concepts covered in this course cannot be addressed with simple home experiments or activities, there are two lab sessions scheduled in which we perform more in-depth activities and use more sophisticated technologies (e.g. scanning electron microscopes, optical microscopes).

To get a grade in this course you **MUST** attend Labs One and Two. The Lab schedule is posted below and in the announcement section of the course. Please sign up for only ONE session for Lab 1 and only ONE session for Lab 2. Email Frank (frank.mayer@asu.edu) if you have questions.

**** Lab Report** - Each lab will be followed by a Lab Report to be completed within 2 weeks of Lab. The Lab Report will be a one page, double spaced, 12pt font report on a topic from the material covered in Lab. It must have a title and your name on it. They will be turned in through announcements in Blackboard. They will be posted after each lab. Students who are granted

permission to attend the Make up Lab session, will turn the report in after the Make up Lab session.

Lab sessions are scheduled as follows:

Lab One - Week 2			
DAY	Session	Time	Link
Tues	1	8:30 am - 10:30 am	http://spring2015-lab1-session1.eventbrite.com
Tues	2	10:30 am - 12:30 pm	http://spring2015-lab1-session2.eventbrite.com
Tues	3	1:00 pm - 3:00 pm	http://spring2015-lab1-session3.eventbrite.com
Tues	4	3:00 pm - 5:00 pm	http://spring2015-lab-session4.eventbrite.com
Wed	5	8:30 am - 10:30 am	http://spring2015-lab1-session5.eventbrite.com
Wed	6	10:30 am - 12:30 pm	http://spring2015-lab1-session6.eventbrite.com
Wed	7	1:00 pm - 3:00 pm	http://spring2015-lab1-session7.eventbrite.com
Wed	8	3:00 pm - 5:00 pm	http://spring2015-lab1-session8.eventbrite.com
Thurs	9	8:30 am - 10:30 am	http://spring2015-lab1-session9.eventbrite.com
Thurs	10	10:30 am - 12:30 pm	http://spring2015-lab1-session10.eventbrite.com
Thurs	11	1:00 pm - 3:00 pm	http://spring2015-lab1-session11.eventbrite.com
Thurs	12	3:00 pm - 5:00 pm	http://spring2015-lab1-session12.eventbrite.com
Friday	13	8:30 am - 10:30 am	http://spring2015-lab1-session13.eventbrite.com
Friday	14	10:30 am - 12:30 pm	http://spring2015-lab1-session14.eventbrite.com
Friday	15	1:00 pm - 3:00 pm	http://spring2015-lab1-session15.eventbrite.com

Lab Two - Week 9			
DAY	Session	Time	Link
Mon	17	8:30 am - 10:30 am	http://spring2015-lab2-session17.eventbrite.com
Mon	18	10:30 am - 12:30 pm	http://spring2015-lab2-session18.eventbrite.com
Mon	19	1:00 pm - 3:00 pm	http://spring2015-lab2-session19.eventbrite.com
Mon	20	3:00 pm - 5:00 pm	http://spring2015-lab2-session20.eventbrite.com
Tues	21	8:30 am - 10:30 am	http://spring2015-lab2-session21.eventbrite.com
Tues	22	10:30 am - 12:30 pm	http://spring2015-lab2-session22.eventbrite.com
Tues	23	1:00 pm - 3:00 pm	http://spring2015-lab2-session23.eventbrite.com
Tues	24	3:00 pm - 5:00 pm	http://spring2015-lab2-session24.eventbrite.com
Wed	25	8:30 am - 10:30 am	http://spring2015-lab2-session25.eventbrite.com
Wed	26	10:30 am - 12:30 am	http://spring2015-lab2-session26.eventbrite.com
Wed	27	1:00 pm - 3:00 pm	http://spring2015-lab2-session27.eventbrite.com
Wed	28	3:00 pm - 5:00 pm	http://spring2015-lab2-session28.eventbrite.com
Thurs	29	8:30 am - 10:30 am	http://spring2015-lab2-session29.eventbrite.com
Thurs	30	10:30 am - 12:30 pm	http://spring2015-lab2-session30.eventbrite.com
Thurs	31	1:00 pm - 3:00 pm	http://spring2015-lab2-session31.eventbrite.com

All labs are in [PSH 563](#).

Make-Up Labs (**by permission only**)

Exams

There are three exams administered in this course. The first will cover material from weeks 1 through 4. The second will cover material from weeks 5 through 9. The Final exam will be given on Week 14 and will be cumulative. These exams will be posted electronically and graded automatically once submitted. The exams will be available on Thursday of the week scheduled and will be due by Sunday midnight at the end of that week.

Research Paper

Students will complete a Research Paper on a topic of their choice from the material covered in this course. **It should be a double spaced, five page paper with one inch margins, 12pt font and name on the top.** The report is worth 50 pts.

References (with whatever format you are comfortable using) should be included at the end of the paper

Please attach using one of the following formats (.doc .pdf or .txt). Include your last name and topic in the file name:e.g., **mayerinfraredtechnology.doc**

Due dates for all submissions is on or before midnight Sunday, April 12 (end of Week 12) - **5 points will be deducted per week for late submissions!!!**

Academic Integrity

Appropriate online classroom behavior is defined by the instructor. You are encouraged to study and collaborate with other students in general terms (did you understand this question?) Any form of copying or cheating on quizzes or exams is strictly forbidden. You may NOT share exam questions.

Students are required to adhere to the behavior standards listed in Arizona Board of Regents Policy Manual Chapter V – Campus and Student Affairs: Code of Conduct (http://www.abor.asu.edu/1_the_regents/policymanual/chap5/chapter_v.htm#5-302), ACD 125: Computer, Internet, and Electronic Communications (<http://www.asu.edu/aad/manuals/acd/acd125.html>), and the ASU Student Academic Integrity Policy (http://www.asu.edu/studentaffairs/studentlife/judicial/academic_integrity.htm).

Students are entitled to receive instruction free from interference by other members of the class. If a student is disruptive, an instructor may ask the student to stop the disruptive behavior and warn the student that such disruptive behavior can result in withdrawal from the course. An instructor may withdraw a student from a course when the student's behavior disrupts the educational process under USI 201-10 <http://www.asu.edu/aad/manuals/usi/usi201-10.html>.

Instructor Responsibilities

Checking In

As we are constantly developing this course, we are always willing to talk about any suggestions or comments you have regarding the course. Frank, or Elizabeth, can be contacted via email. See the [Contacts](#) page or the Staff Information section for more info. If you have technical problems with the course, please contact the ASU Help Desk staff at helpdesk@asu.edu or (480) 965-6500.

Grading

On each Monday morning, we will collect the Activity Reply and the scores for the Exercise submitted the previous week. The Activity Replies and the Exercise scores will be generated automatically and entered into a spreadsheet. The Exam scores will similarly be processed automatically. If you have any questions about your scores, please email Frank Mayer.

Grading Scale

There are 464 possible graded points available in this course. All points (except the on-campus labs) will be earned via Web-based interaction so it is critical that your Web browser can handle the scripts necessary to submit your work.

14 Exercises	@10 pts/exercise	= 140
12 Activity Replies	@2 pts/activity	= 24
3 Exams	@50 pts/exam	= 150
1 Research Paper	@50 pts	= 50
2 Labs and Lab Reports	@50 pts/lab	= 100

>460	=	A+
445 - 459	=	A
430 - 444	=	A-
390 - 429	=	B
330 - 389	=	C
270 - 329	=	D
< 269	=	E

***Extra Credit may increase your total points - it will not impact the total points for the class.**

By Week

- Week 1 - [The Path of Light](#)
- Week 2 - [Reflection & Refraction](#)
- Week 3 - [Lenses and Fresnel Lenses](#)
- Week 4 - [The Photon](#)
- Week 5 - [The Spectrum](#)
- Week 6 - [Rainbows & Blue Sky](#)
- Week 7 - [Interference Colors](#)
- Week 8 - [Color and Polarized Light](#)
- Week 9 - [Optical Spectroscopy](#)
- Week 10 - [Electrons in Atoms](#)
- Week 11 - [Visible Light, IR, X-rays, UV](#)
- Week 12 - [Optical Microscopy](#)
- Week 13 - [Electron Microscopy Activity](#)
- Week 14 - [Analysis of Mars and Earth using PIXE](#)

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Readings

- [The Path of Light](#)
- [Rainbows](#)
- [Rainbows, Part II](#)
- [Rainbows, Part III](#)
- [Rainbows, Part VI](#)
- [Light Inside the Rainbow](#)
- [The Double Rainbow](#)

- [Photography with a Pinhole Camera](#)
- [Blue Skies & White Clouds](#)
- [The Reflection of Light](#)
- [Color, Thin Films, and Interference](#)
- [The Refraction of Light](#)
- [Polarized Light](#)
- [The Refraction of Light, Part II](#)
- [Optical Spectroscopy & Neon Lights](#)
- Lenses and Geometrical Optics
- Visible/X-Rays/UV/IR
 - [Visible Light and X-Rays](#)
 - [Infrared and Ultraviolet Light](#)
 - [X-Radiography](#)
- [Part I](#)
- [Part II](#)
- [Part III](#)

- [Fresnel Lenses](#)
- [The Photoelectric Effect](#)
- [Life Cycle of the Photon](#)
- [Silicon - a Material Transparent to Infrared](#)
- [Mechanism for the Absorption of Light](#)
- Color
- Electrons in Atoms
 - [The Electron](#)
 - [Electrons in Atoms](#)
- [Color and Light](#)
- [Sources of Light](#)
- [Composition of Color](#)

- Lasers
- Optical & Electron Microscopy
 - [Optical Microscopy](#)
 - [Optical vs. Electron Microscopy](#)
 - [Electron Microscopy](#)
- [Lasers](#)
- [Holograms](#)

- [Vacuum Technology](#)
- [X-Ray Emission: Earth, Moon, & Mars](#)
- [Scanning Probe Microscopy](#)

For more information about these topics, view our [Book References](#)

Activities

- [The Pinhole Scope](#)
- [Mirrors and Reflection](#)
- [The Bent Pencil](#)
- [Lenses](#)
- [Fresnel Lenses](#)
- [Measurements and Estimates](#)
- [The Photon](#)
- [The Spectrum](#)
- [What Causes Rainbows?](#)
- [Remote Analysis on Earth](#)
- [Why is the Sky Blue?](#)
- [Why are Bubbles so Colorful?](#)
- [Color](#)
- [Polarized Light](#)
- [Electrons in Atoms](#)
- [X-Rays, UV, and IR](#)
- [Optical Microscopy](#)
- [Ion Beam Analysis using PIXE](#)
- [Scanning Probe Microscopy](#)
- [Real and Virtual Images](#)

For more information about these topics, view our [Book References](#)