PHYS-203L Atomic & Molecular Physics Lab Spring 2026

Class Mtgs: T 8:30 AM - 11:30 AM Instructor: Dr. Fatima
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Office Hours & Location: M/W 11:0AM – 12:00 PM & 1:00 PM – 2:00 PM
(Trexler 172 A/via zoom by appointment)

Required Materials:

Materials are available online through Inquire, including lab instructions and additional readings as needed. You may print the materials needed for lab before each weekly session, or you may access them through your laptop with a digital file. You may not access the lab on your phone or on the lab computer. A bound lab notebook with sewn graph paper pages is needed, as well as a scientific calculator that is not a cellphone, and a pencil or pen. Physics 202 is a prerequisite for this course.

Goals:

Modern physics is the third and last course in the introductory undergraduate sequence.
Modern physics is the physics of the 20th Century as it relates to quantum theory and relativity. This course presents experiments that were performed initially to support modern physics concepts, which includes physics of very small and/or very fast particles. In conducting these notable experiments, you will have an opportunity to practice data analysis and refine your scientific report writing skills. Hopefully, concepts presented in Physics 203 will be reinforced as they are applied in the laboratory setting.

Intended Learning Outcomes:

The following learning activities will serve as the foundation for the lab exercises: The successful student will:

1. explore open-ended questions that highlight course-related phenomena.
2. write clearly and insightfully about physical phenomena, graphical results, and experimental error.
3. design experimental testing of hypotheses in part and/or in full to meet the laboratory purpose(s).
4. deepen their understanding of both systematic and random error, as applied to physical results.

General Attendance Policy:

Since a portion of your grade in 203 (20%) depends on the laboratory, you must enroll in both the "lecture" and laboratory sections of 203. The lab starting and ending times are firm, although it may sometimes be possible to complete the lab before the published ending time. You will be allowed one late entrance to the lab up to 15 minutes after the set starting time, i.e., <8:45. Alternative arrangements (e.g., make-ups) will only be entertained as a result of a discussion with me beforehand or an emergency note (death, hospitalization, misdemeanor, etc.) signed by a governing official (medical doctor, parent, law enforcer, etc.).

Academic Integrity:

We should treat our laboratory classroom hours together with mutual respect, to create a great environment for learning physics. Considering this, you must turn off cell phones, PDAs, etc. during lab. In this lab collaboration is encouraged. Collaboration relies on the individual strengths and contributions of each group member to produce a deeper level of understanding. Plagiarism exists when someone takes

personal credit for another's creative (usually written) work or does not reformulate or rephrase material another individual has written. Please be advised that the RC AI policy will be upheld within this course.

Make-Up Labs:

The last week of the semester is designated for make-up labs. You will be allowed to make up at most two labs during that week, however.

Grading:

Unless otherwise specified, written lab reports for each exercise are due two weeks from data completion. Typed reports are acceptable that follow in the order presented below. Please submit in PDF only in Inquire. **Please note that a deduction of 5 points will occur for every day a lab is late past the specified due date.** A percentage breakdown of how the total grade is determined is as follows: Cover "page" (aka. Heading) 5%, Abstract 20%, Introduction 15%, Data and Results 40%, and Discussion 20%. Each required section of the lab is briefly described below. Although we will discuss lab writing throughout the course, please have a look at the sample lab posted on the NQR pages as a guide as well as the lab writing rubric.

The lab grade will be composed of:

Attendance and Participation	30%
Lab Reports	70%

A percentage breakdown of how the grade for each lab is determined can be found on the following page.

Grading Rubric:

Section 1, Abstract: Total 15 points

Purpose (2 points)
Brief procedure (1 point)
Principal results (6 points)
Error analysis (2 points)
Validity of results/supports purpose (4 points)

Section 2, Introduction: Total 15 points

Statement of primary physics concepts in words (4 points)
Principal equations (4 points)
Definition of terms (3 points)
Written summary of data taken, and analysis performed (4 points)

Section 3, Data and Results: Total 15 points

Data Tables (1-2 points each)
Graphs (0-5 points) *
Sample Calculations (3 points)
Definition of terms with units (2 points)
*If no graphs, these points will be reassigned

Section 4, Discussion: Total 15 points

Expansion/statement of primary physics concepts (5 points)
Answers to questions (3 points)
Statement of results (1 point)
Error analysis (3 points)
Validity of results/purpose supported (3 points)

[Formatting]: Total 4 points
Descriptive Title/name(s)/date (2 points)
1.5 Spacing (1 point)
Reasonable margins and font size (1 point)

Additionally, reports will be graded for the 3 C's of Communication for a total of 36 points:
Completeness: 12 points (3 points for each section)
Conciseness: 12 points (3 points for each section)
Clarity: 12 points (3 points for each section)
This grading rubric places an emphasis on good scientific writing. Specifically, this means that: (i) ideas must be expressed fully without excessive wordiness or repetition; (ii) each topic must be stated in a clear manner that does not create confusion for the reader; (iii) the different parts of the report are clearly connected and cohesive (e.g., the discussion ties together the ideas presented in the introduction and the abstract summarizes all important elements in the experiment).

Disability Support Services:
Accessible Education Services (AES) is in the Goode-Pasfield Center for Learning and Teaching in **Fintel Library**. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Becky Harman, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Becky Harman at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.

Tentative Schedule:

Date	Lab Topic
January 13	Function Generator and Oscilloscope Basics
January 20	Oscilloscopes and Filtering
January 27	Speed of Light Using a Laser
February 3	Speed of Light Using Optical Fiber
February 10	Charge to Mass Ratio of an Electron
February 17	**Exam 1**
February 24	Franck-Hertz Experiment
March 3	Spring Break!
March 10	Photoelectric Effect Using Mercury Light

March 17	Photoelectric Effect Using LEDs
March 24	**Exam 2**
March 31	Young's Double Slit Experiment
April 7	Radioactivity
April 14	Make-up

Disclaimer: Everything above is subject to change with notice and, where appropriate, your approval.