Lyon College: Standard Course Policies, Fall, 2023

These policies apply to all courses offered at Lyon College. Details related to a specific course can be found in the rest of the course's syllabus.

Honor Code

All graded work in this class is to be pledged in accordance with the Lyon College Honor Code. The use of a phone for any reason during the course of an exam is considered an Honor Code violation.

Class Attendance Policy

Students are expected to attend all class periods for the courses in which they are enrolled. They are responsible for conferring with individual professors regarding any missed assignments. Faculty members are to provide absence notification through the Early Alert System which informs the academic advisor, Director of Student Success, and the Provost when a student misses the equivalent of one, two, three, and four weeks of class periods in a single course. Under this policy, there is no distinction between "excused" and "unexcused" absences, except that a student may make up work missed during an excused absence. A reminder of the College's attendance policy will be issued to the student at one week, a second reminder at two weeks, a warning at three weeks, and notification of administrative withdrawal and the assigning of an "AW" grade at four weeks.

Academic Support

The Morrow Academic Center (MAC) assists students who want to improve grades or academic skills by providing peer-led services including Supplemental Instruction (SI), tutoring, the Writing Center, and academic coaching as well providing 24-hour, online tutoring for all subjects through online tutoring. A schedule of peer-led services is available at lyon.edu/mac and online tutoring is accessed through courses in Canvas. Contact Donald Taylor, Director of Academic Support and Accessibility, at (870) 307-7319 or donald.taylor@lyon.edu for more information about MAC services.

Technology Support

For general technology support, you can contact the IT department by emailing support@lyon.edu or by calling 870-307-7555. For assistance with classroom-related technologies, such as the learning management system (LMS), you can request support using the methods above, or you can contact sarah.williams@lyon.edu directly for assistance.Your course content will be accessible digitally using the Canvas LMS, which uses your myLyon credentials for your student login.

- For Canvas, login at lyon.instructure.com

Disabilities

Students seeking reasonable accommodations for learning, psychological, or physical disabilities must contact Donald Taylor, Director of Academic Support and Accessibility, in the Morrow Academic Center at (870) 307-7319 or at donald.taylor@lyon.edu.

Harassment, Discrimination, and Sexual Misconduct

Lyon College seeks to provide all members of the community with a safe and secure learning and work environment that is free of crime and/or policy violations motivated by discrimination, sexual and bias-related harassment, and other violations of rights. The College has a zero-tolerance policy against gender-based misconduct, sexual assault, and interpersonal violence toward any member or guest of the Lyon Community. The College encourages anyone experiencing or knows of someone experiencing harassment, discrimination, or sexual misconduct to speak to and file an official report with our Title IX Coordinator, located on the first floor of the Edwards Commons Building #27, in the Student Life suite. All college employees (faculty, staff, administrators) are required to report actual or

suspected incidents of harassment, discrimination, intimidation, and violence to appropriate officials immediately. However, there are limited exceptions, referred to as confidential reporters (Campus Clinic Director, the Chaplain, or the Director of Mental and Behavioral Health). Confidentiality will be maintained to the greatest extent possible within the constraints of the law. Title IX Reporting Tool. Lyon College Title IX Policy.

Mental & Behavioral Health

Lyon College is dedicated to ensuring each student has access to mental and behavioral health resources. The College's Mental and Behavioral Health Office is located in Edwards Commons and is partnered with White River Health's Behavioral Health Clinic. The office is committed to helping the Lyon community achieve maximum mental and behavioral wellness through both preventative and reactive care. A full-time, licensed, professional counselor provides counseling, consultations, outreach, workshops, and many more mental and behavioral services to Lyon students, faculty, and staff at no cost. The Mental and Behavioral Health Office also provides access to White River Health's services and facilities, including medication management and in-patient and out-patient care. To make an appointment, contact counseling@lyon.edu.

College-Wide COVID-19 Policies for Fall, 2023

The federal COVID-19 Public Health Emergency Declaration ended on May 11, 2023. **Except for individuals who, post-infection, may be directed to do so by Jennifer Morrison, Director of the Campus Clinic, masking will not be required in any campus space.** Vaccines are strongly encouraged for all faculty, staff, and students. Vaccines are not mandated for Lyon College community members, although there may be specific courses involving travel or interactions with vulnerable, external populations where a vaccine may be required.

Tentative Syllabus for Physics Lab 241: Fall 2023

Professor: Dr. Stuart Hutton

Office: Derby Center: 248 Research Lab: Derby 219: General Physics lab: 148

SMS: 307.*.8765 /lab email: lyonphysics@<*.com> web: physics.lyon.edu**

Phone: *.307.7560 Email: stuart.hutton@lyon.edu**

Note this very clearly: labs are due by lab time 1 week after completing the lab. Up to 1 week late, you lose ½ credit for the lab (2 ½ credit deductions lowers your final grade by a letter grade; more than 6 ½ credit deductions will result in course failure.) Labs are not accepted more than 2 weeks after completion of the lab (this includes the time required for revisions) and your final grade will be reduced by a letter grade each time. Additionally NO labs will be accepted after the last day of classes which is December 08, 2023. If you fail to receive accepted for more than 3 labs, you will fail the course. Any required revisions must be completed within the same 2 week time frame (the 2 week time frame starts on the day of the lab) or they are not accepted which again results in your final grade being reduced by a letter grade.

Grading

As a general guide to grades, grades will be assigned as follows:

100-90]	(90-80]	(80-70]	(70-60]	<(60
A	B	C	D	F

There are about 10 labs this semester and each lab provides 10 points in your final grade. The particular grade in each individual lab is awarded as follows: 100% of the grade (or 7 points) is awarded for successful completion of the lab awarded contingent upon submission of an acceptable lab report following the guidelines and rubric on the lab website. Note, however, that in the event that an acceptable lab report is not submitted, the lab is considered to not have been done and the final course grade will be lowered by 1 letter grade. **If you fail to submit more than 3 accepted reports, you will fail the course.** Each student is to submit an individual and independent electronic lab report for each experiment completed and the report must be accepted in order to obtain credit. You will have the opportunity to respond to comments from the received electronic labs and then revise and resubmit your reports. Refer to Student Learning Outcomes for a discussion of minimal course outcome expectations.

Note: If you miss one of the labs when experiments are done and it is not made up, your lab grade will be lowered by one letter grade for each missed lab which is not made up. The full lab, including writeup, must be completed or your grade will be reduced by one letter grade for each lab not fully completed. You must make up any excused absences at the first opportunity.

It is important that you understand what you did during the lab before turning the lab report in to your professor. Your work on lab write-ups will be graded for correctness, clarity and completeness. If you want full credit for a lab, **you must** supply the logical steps that led to the result and the result **must include proper units**. You should supply sample calculations where appropriate. Diagrams and graphs should be included where appropriate. Aside from data tables and graphs, the components required for the proper lab write-up should take about 2 - 3 pages maximum for any given lab. Be sure that each lab starts with a cover page as indicated in the lab write-up guidelines. Make sure that your lab write-up is in the form of paragraphs with correct English grammar as indicated on the lab write-up guidelines. Failure to follow the guidelines will negatively impact your grade.

Phy241 is a separate course from either Phy210 or Phy240.
The grade in Phy241 has no impact upon the grade in either Phy210 or Phy240 except as a co-requisite.

In this course, your grade will depend upon successful completion of lab experiments and reports. **You are also expected to have read the lab before coming to class and to have reviewed the lab material.** You should bring your text, a calculator, and paper to lab. Labs will be completed and submitted during lab. In order to do this, you will need to come to lab on time. Making up the lab for such absences is normally not permitted: it is thus in your interest to show up to lab on time. Additionally, you should **never plan** other activities during the lab period since labs normally will occupy the entire period. Your prime learning resource is the classroom: **punctual** and **complete** class attendance is expected**. Absences will negatively impact your final grade**. Do not show up late to lab because the entire lab has to wait on your appearance.

Lab report formats

If you miss a lab for an excused reason, you must make up the lab as soon as possible. If you fail to hand in a lab report late which is accepted, you will lose a minimum of 10% of your grade final grade. Labs must be submitted in **pdf** format electronically. **When including spreadsheet screen captures in your reports, be sure to format tables so they fit on the page and are completely readable. I should be able to read your lab (as a single document in pdf format) without having to change anything. This means, check (proofread) your pdfs before you send them to make sure you can read them. Specifically, you must check your sent email to confirm that any attachments sent were correctly attached, could be opened, and were in pdf format. Do not submit links to documents; your report is a pdf attachment to your email.**

If you miss one or more of the labs without makeup, your lab grade will be lowered by one letter grade for each missed lab which is not made up. Do not submit non-pdf attachments or corrupted files via email and expect to obtain extra time to complete the lab.

Course Description

In this course you will be exposed to the experimental side of physics. Among the topics that we will investigate are mechanics, waves, and thermodynamics.

Course Objectives

As a consequence of this course, you should obtain an enhanced understanding of the experimental nature of physics. In addition, you should come away from this course with an ability to interpret data in a scientifically valid manner and to have increased experience with writing brief technical reports. Refer to Student Learning Outcomes for a discussion of minimal course outcome expectations.

Course Prerequisites

In order to be taking the physics lab, you must be currently enrolled in either physics 210 or physics 240 and therefore you must satisfy the prerequisites for those courses.

Text

The text will consist of handouts in electronic format obtained via the physics gateway at: http://physics.lyon.edu

Academic Integrity

Each student is to submit an individual and independent electronic lab report for each experiment completed and the report must be accepted in order to obtain credit. Students are specifically prohibited from reference to lab reports prepared by other students or work performed in previous semesters in the preparation of their own reports. However, you are encouraged and expected to feel free to ask colleagues questions during lab and in the preparation of your reports. Never-the-less, **your submission must represent your own work.** And, as a note: if you try to use AI to do this, you can almost be sure you're going to get the physics wrong (I have tested this several times.) In short, don't use AI; it does not represent your own work and it's going to almost certainly be wrong. I consider the use of AI to write your submissions to be an honor code violation.

CLASS SCHEDULE / OFFICE HOURS Fall 2023

Professor: Stuart Hutton

Monday	Tuesday	Wednesday	Thursday	Friday
8:00-8:50 PHY240.01 Fundamentals of Physics I Derby 007	8:00-9:15	8:00-8:50 PHY240.01 Fundamentals of Physics I Derby 007	8:00-9:15	8:00-8:50 PHY240.01 Fundamentals of Physics I Derby 007
9:00-9:50 PHY210.01 General Physics 1 Derby 007	9:30-10:00	9:00-9:50 PHY210.01 General Physics 1 Derby 007	9:30-10:00	9:00-9:50 PHY210.01 General Physics 1 Derby 007
10:10-10:50 Office Hours	10:00 - 10:50	10:10-10:50 Office Hours	10:00 - 10:50	10:10-10:50 Office Hours
11:00-11:50 Phy321.01 Astrophotography Derby 148	11:00-11:50 Phy382.01 Special Topics E&M Derby 148	11:00-11:50	11-11:50	11:00-11:50
12:00-12:50	12:00-12:50	12:00 - 12:50	12:00 - 12:50	12:00 - 12:50 SGA
13:00-13:50 14-15:50 Phy382.01 Special Topics E&M Derby 148	13:00-14:50	13:00-15:50 PHY241.01 Fundamentals of Physics Lab 1 Derby 148	13:00-15:50 PHY241.02 Fundamentals of Physics Lab 1 Derby 148	13:00-15:50 PHY241.03 Fundamentals of Physics Lab 1 Derby 148

Schedule for Phy210, Phy240, and Phy241: Fall 2023: Revision 01

labs	Worksheet Number	Date	210: Cutnell: 8th ed. Assignment Reading : Homework	240:Serway 4th ed Assignment: Reading: homework
WRF Lab 00: intro lab	Class Initialization	W August 23	Chapter 01: Units, vectors, math and trig	Chapter 01 Introduction and Vectors
	Worksheet 01 units trig	F August 25	Chapter 01:H01	Chapter 01:H01
	Worksheet 02 1d motion	M August 28	Chapter 02:H02: 1d motion	Chapter 02:H02 1d motion
WRF Lab 01: Forces & Vectors	Worksheet 03 free fall	W August 30	Chapter 02:H03	Chapter 02:H03
	Worksheet 04 2d motion1	F September 01 **UQ01**	Chapter 03:H04: 2d motion	Chapter 03:H04: 2d motion
	Labor Day Holiday	M September 04		
WRF Lab 02: 1 and 2 D motion Problems	Worksheet 05a 2d motion2	W September 06	Chapter 03:H05	Chapter 03:H05
	Worksheet 05 2d motion2	F September 08	Chapter 03:H05	Chapter 03:H05
	Worksheet 06 force1, fbd	M September 11 **UQ02**	Chapter 04:H06: Forces, fbd	Chapter 04:H06 Forces, fbd
WRF Lab 03: Planes & Friction	Worksheet 07 force 2, fbd	W September 13	Chapter 04:H07	Chapter 04:H07
	UnTest#1	**F September 15**		
	Test 1	**M September 18**		
WRF Lab 04: Atwood's, mechanical advantage, work & Energy	Worksheet 08 inclined plane	W September 20	Chapter 06:H08: work and energy	Chapter 06:H08 Energy and Energy Transfer
	Worksheet 09 inclined 2	F September 22 **UQ03**	Chapter 06: H09	Chapter 07:H09 Potential Energy
	Worksheet 10 energy 2	M September 25	Chapter 07:H10: impulse, momentum	Chapter 08:H10 Momentum and Collisions
WRF Lab 05: Centripetal Force & Hooke's Law	Worksheet 11 spring energy	W September 27	Chapter 07: H11	Chapter 08:H11
	Worksheet 12 collisions1	F September 29 **UQ04**	Chapter 05:H12: Uniform Circular Motion	Chapter 10:H12 Rotational Motion
	Worksheet 13 collisions2	M October 02	Chapter 08:H13: Rotational kinematics	Chapter 10:H13
WRF Lab 06: Static Equilibrium	Worksheet 14 ucm 1	W October 04	Chapter 08: H14	Chapter 10:H14
	Worksheet 15 acc frames	F October 06 **UQ05**	Chapter 09:H15: Rotational dynamics	Chapter 10:H15
	Fall Break	**October 07 – October 10**		
WRF: Lab TBA	Worksheet 16 non ucm	W October 11		
	UnTest#2	**F October 13**		
	Test 2	**M October 16**		
WF: Lab TBA	Worksheet 17: Rotate2 energy	W October 18	Chapter 09: H17	Chapter 10:H17
	Service Day	**R October 19**		
	Worksheet 18 Torque, L	F October 20 **UQ06**	Chapter 09: H18	Chapter 10:H18
	Worksheet 19 statics	M October 23	Chapter 10: H19 Simple Harmonic Oscillation	Chapter 12:H19 Oscillatory Motion
WRF Lab 07: Simple Harmonic Oscillation	Worksheet 20 osc1:spring	W October 25		
	Worksheet 21 osc2:pendulum	F October 27 **UQ07**		
	Worksheet 22 string waves1	M October 30	Chapter 10: H20	Chapter 12:H20
WRF Lab 08: Standing Waves and Vibrations	Worksheet 23:string waves2	W November 01	Chapter 10: H21	Chapter 12:H21
	Worksheet 24 sound waves	F November 03 **UQ08**	Chapter 16:H22 waves and sound	Chapter 13:H22 Mechanical Waves
	Worksheet 25 beats, Doppler	M November 06	Chapter 16:H23	Chapter 13:H23
WRF Lab09: Archimedes' Principle & Pressure	**UnTest 3**	**W November 08**		
	Test 3	**F November 10**		
	Worksheet 27 therm 01	M November 13	Chapter 12: Temperature and Heat	Chapter 16: Temperature and the kinetic theory of gasses
WRF Lab 10: Thermodynamics	Worksheet 28 therm 02	W November 15	Chapter 13:H27: transfer of heat	Chapter 16:H27
	Worksheet 29 therm 03	F November 17 **UQ09**	Chapter 14:H28: IDG and kinetic theory	Chapter 17: H28:Energy in Thermal Processes: 1st law of thermo
	Worksheet 30 therm 04	M November 20	Chapter 15::H29: thermodynamics	Chapter 18: H29: Heat Engines, Entropy, and the 2nd law of thermo
	Thanksgiving	**November 22 – November 26**		
	Worksheet 30 (continued)	M November 27	Chapter 15: H30	Chapter 18:H30
WRF: Lab TBA	Worksheet 26	W November 29	Chapter 17: H25	Chapter 14:H25
	Untest #4	**F December 01**		
	Test 4	**M December 04**		
[WRF: No Lab]	Worksheet 26 Archimedes Worksheet 31 Fluids 1 {Gravitational Interactions}	W December 06	Chapter 11: H31: Fluids	15: H26:Fluid Mechanics :Sections 15.1 – 15.4 Chapter 16: H31:Fluid Mechanics: Sections 15.5-15.9
	Course Review / last day	**F December 08**	**Final Exams**	**December 10 – December 15**

Physics Problem Solving Rubric Rev FA2023

Note: this rubric indicates the process for completion of physics problems. Since our tests are now multiple choice, this should be viewed as a self-guided checklist for successful and complete problem completion. For sample calculations in lab reports, you should follow this rubric closely.

	1	**0.7**	**0.4**	**0**
1, Critical Thinking: Solution started correctly. Note: sketches may be considered here as required in problem statement.	correct approach If required, sketches were correct.	approach would lead to correct result Sketches miss one label or some other component absent or incorrect.	Something is right in the approach but insufficient to reach problem solution. Sketches miss multiple labels, directions incorrectly indicated	incorrect approach Sketch not present or not at all correctly labeled.
2. Quantitative Literacy: Solution proceeded quantitatively	Mathematical operations correct and units correct	Mathematical operations and units correct however an error usually related to incorrect units or the final numerical result present	Mathematical operations have some correct steps but misapplication or other errors prevented problem completion. Units reported in final result not present or incorrect .	Necessary mathematical operations incorrect and units absent
3, Scientific Thought & Informational Literacy Note: this may be contained within an equation starting the problem solution.	correctly stated physical principle or law and physical terminology needed to solve problem.	physical principle or law used shown however omission or extraneous material present. physical terminology needed to solve problem used but not complete or absent important concept.	statement of physical principle or law present but would not apply to present problem so as to lead to solution. physical terminology needed to solve problem incomplete and would not have lead to problem completion.	no statement of physical principle/ law or incorrect physical principle/ law. Did not use physical terms needed to solve problem or incorrect terms used.

Problem scoring: maximum per **problem section** is about 5 points, some sections may have fewer points. In a test containing 4 problems, this equates to 25% of the total test score. The final score per problem is calculated as follows:

$$P_i = \frac{\text{total number of points from rubric}}{\text{maximum rubric points per problem}} \times \frac{100}{\text{\# of problems on test (normally 4)}}$$

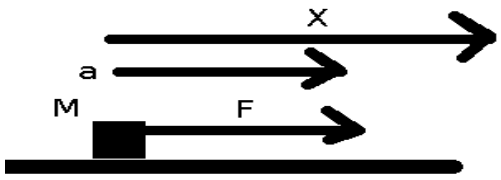
The test score is then determined by

$$\text{percentage test grade} = \sum_{i=1}^{i=\text{Number of problems on test}} P_i$$

Example of a complete solution

Find the vector position at time t of an object of mass M when subjected to a constant force $\vec{F}=F\hat{x}$ for a time t if the object was initially at x=0 and at rest. Provide a numerical result with correct SI units for F=1 N, M=1/2 kg and t=2 s. Include a correctly labeled sketch showing F acting on M, a and x.

Solution:



Newton's law: $\vec{F}=M\vec{a}\Rightarrow\vec{a}=\frac{\vec{F}}{M}:\vec{F}=F\hat{x}\Rightarrow\vec{a}=\frac{F}{M}\hat{x}$: $a_x=\vec{a}\cdot\hat{x}=\frac{F}{M}$

Constant force : kinematic equations of motion in x direction for position:

$$x=x_0+v_{x,0}t+\frac{1}{2}a_x t^2$$

Object initially at rest: $v_{x,0}=0\ \text{m/s}$. Object initially at x=0: $x_0=0\ \text{m}$.

Kinematic equation reduces to: $x=\frac{F}{2M}t^2$

With numerical values: $x=\frac{1\,\text{N}}{2\left(\frac{1}{2}\text{kg}\right)}(2\,\text{s})^2=4\frac{\text{Ns}^2}{\text{kg}}=4\,\text{m}$

Final answer with vectors: $\vec{x}=4\,\text{m}\,\hat{x}$

Score:

1: Started with Newton's law and used correct equation of motion, additionally a correctly labeled sketch was drawn showing correct vector directions as was required=1

2: Algebra (including vectors) correctly lead to final result, unit algebra correct=1

3: Correctly used physical information in the problem which were mass M, initial conditions (at x=0, at rest) , time t, constant force, vector directions. Correct numerical quantities (including correct vectors) provided in final result with correct SI units reported=1

Notes on the lab write-up for physics labs Fall 2023

Your first (cover) page should include the following information:
Your Name, Date, Partners, Title of Experiment and the abstract.
(Then insert a page break)

Each lab must be the unique written effort of the student submitting the report. You may NOT reference or use lab reports (prepared by others) in your report preparation although you are most certainly encouraged to talk to your lab colleagues.

Lab reports must be electronically submitted to the appropriate address as a single pdf document. Links to external documents are not accepted.

Title: Concise wording that describes the essence of the lab.

Abstract - a summary of your research including general methods and major conclusions. This is usually one paragraph long and should convince someone to read your paper. Include a statement of your hypothesis here and if data supported it.

Introduction: An overview of your experiment, statement of hypothesis, what you did and what the theory was behind the experiment.

Methods: - A brief discussion of experimental techniques. Diagrams are usually appropriate in this section.

Results -written usually in the past perfect tense or passive voice; describes your findings, data collected, and includes data tables, graphs, general trends, derived formulas, etc. All work and data tables must be shown here. In general, you need to have a copy of your original data with you but the data included in the lab report can be copied from your original data. Data should be absent of obvious errors (since you would have tracked down these items).

Discussion and analysis - tense can vary, describes your results in relation to other data, discusses problem associated with the lab, postulates trends in the data, predicts results given different circumstances, suggests sources of error, etc. Discuss how the data supports, or does not support your hypothesis and how well such support is in terms of error analysis such as percent differences. **Be sure to include sample calculations in this section.**

Literature Cited - a list of books, articles, etc., that you used to assist you in presenting your data and which were referred to in the write-up. **When citing a reference from the internet, you MUST include the URL that points directly to the document so that a single click of the mouse will bring up that exact document. Every lab report will have at least 1 citation or the report will not be accepted.**

Your presentation of the lab is important. Be sure it is grammatically correct and neatly typed. Be careful of tense changes within a paragraph. Data collected during a lab must be authentic. "Fudging" is unacceptable and unnecessary.
Lab write-ups should be as **concise** as possible within these guidelines. I am not looking for exhaustive tomes of work in a lab write-up.

Physics Lab Grading Rubric Fall 2023

Note: Each student has the opportunity to revise deficient portions of the lab report during the lab period except for teamwork, arrival and departure. This should be regarded as a guide to required elements of a completed lab.

	1	0.5	0
Scientific Thought	Hypothesis in abstract and introduction. Supporting evidence (or non-supporting) discussed in conclusion.	Hypothesis in abstract and introduction but not relevant and supporting evidence (or non-supporting) not discussed in conclusion.	Hypothesis absent in abstract and introduction; Supporting evidence (or non-supporting) not discussed in conclusion
Critical thinking	Correct discussion of experiment, and how results relate to hypothesis.	Incomplete discussion of experiment iand how results relate to hypothesis	poor of absent discussion of experiment, and how results relate to hypothesis.
Inquiry and Analysis	Complete discussion of experimental technique and data results	incomplete discussion of experimental technique and data results	poor or absent discussion of experimental technique and data results
Informational Literacy	Correct physical terminology contained in report. At least one reference present.	incomplete physical terminology contained in report. Reference present but not correct.	incorrect or absence of physical terminology contained in report. Reference not present.
Quantitative Literacy	Correct usage of calculations including spreadsheets	correct usage of calculations including spreadsheets but something significant missing	Absent or incorrect usage of calculations including spreadsheets
Teamwork	Successful team completion of lab		Unsuccessful team completion of lab
Arrival	on time		tardy or absent
Departure	Work space returned as it was when arriving		Workspace left in disorder upon departure
Overall report	All required elements present		Required elements missing.
Quality	experimental results presented without obvious errors		experimental results presented with obvious errors

Safety regulations for General Physics Labs
Fall 2023

During labs, I will be wearing a face mask.

(1) Anytime springs are used in lab, safety goggles must be worn.
(2) Anytime boiling water is used in lab, safety goggles must be worn.
(3) You should not look at laser light or point it towards other people.
(4) In the event of a spill (which will be water), dispense a towel from the spill kit (aka towel dispenser) and wipe up the spill.
(5) Food and drink are not permitted in lab.

Attach this form to your email (as an extra attachment today) when you send in your introductory lab report. In your lab report, right below your name, you should say this:
I have read the safety regulations attached to this email.

Student Learning Outcomes for the Physics Program at Lyon College FA2023

1. Students who complete the Physics 210/220, 240/250, 241/251 sequence are able to

1a. Articulate the basic principles of Physics.
1b. Apply the basic principles of Physics to solve a variety of qualitative and quantitative problems at the introductory Physics level.

This can be measured with portions of exam problems in Phy210, Phy240, Phy220, and Phy250. This can be measured with rates of accepted lab reports for Phy241, and Phy251.

General Education learning outcomes for Phy210/Phy240/ Phy241/Phy220/Phy250/Phy251

Critical thinking: 210,240,241,220,250,251
Inquiry and analysis: 241,251
Quantitative literacy: 210,240,241,220,250,251
Scientific thought and Information literacy: 210,240,241,220,250,251

Portions related to Phy241,Phy251 will be based upon relative resubmissions for accepted labs throughout the course. Portions related to 210,240,220 and 250 will class exam scores tracked throughout the course.

Critical thinking is regularly evaluated in 210,240,241,220,250,251. It is evaluated in terms of starting with correct Physical principles applicable to a given situation and being able to follow it through to completion. It is evaluated by use of exam problems. In 241/251, it is part of the process of scientific thought and is evidenced by use of supporting data for a hypothesis as is required by the lab rubric.

Inquiry and analysis is regularly evaluated in 241/251 as part of the required element of completed lab writeups. It is evidenced by student explanation of the experiment and is a required element by the rubric.

Quantitative literacy is evidenced primarily in 210/240/220/250 by successful completion of Physical problems with correct units and correct numerical operations. It is evaluated by use of exam problems. Quantitative literacy is exhibited in 241/251 by students being able to follow through with calculations partially enabled by spreadsheet examples and being able to interpret the results. This is evidenced by the accepted writeup following a rubric.

Scientific thought and information literacy is regularly evaluated in 241/251 and is evidenced by use of hypothesis with supporting evidence (or not supporting evidence) based upon experiment as is required by the lab rubric for 3 selected labs. Information literacy is regularly evaluated in 241/251 and is evidenced by correct Physical terminology in lab reports as required by the lab rubric. It is also a significant portion of 210/240/220/250 and is evidenced by student success in using the basic Physical terminology enabling students to correctly initiate quantitative solutions to Physical situations.