



REVISED COURSE OUTLINE FOR REMOTE LEARNING

To account for the necessary transition to remote learning from March 13 onward, adjustments have been made to assessment deadlines and requirements so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff). If you are unable to meet the deadlines or requirements specified, please connect with your course instructor to work out alternative dates/assessments.

1. **Course:** PHYS 229, Modern Physics - Winter 2020

Lecture 01: MWF 10:00 - 10:50 - Remote Learning (check with your instructor or coordinator for details)

Instructor	Email	Phone	Office	Hours
Dr Timothy Friesen	timothy.friesen@ucalgary.ca	403 220-6123	SB 513	M 13:00 - 15:30

Course Site:

D2L: PHYS 229 L01-(Winter 2020)-Modern Physics

Note: Students must use their U of C account for all course correspondence.

2. **Requisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Prerequisite(s):

Physics 211 or 221 or 227; and Mathematics 249 or 265 or 275. Also known as: (formerly Physics 325)

3. **Grading:**

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %
Tophat	3
Tutorials (8)	22*
Quizzes (3)	27*
Laboratory Reports (9)	27*
Poster Presentation	9*
Final Examination	12*

***Indicates a change in weighting to reflect the challenges associated with switching to online delivery of course components in light of the COVID-19 situation. Weight has been shifted from the final exam to other components. This has been done to emphasize largely completed course components.**

Note: If a student's final exam mark is higher than their overall quiz grade, 4% of the weight will be shifted from the quizzes to the final exam (i.e. If you do better on the final exam than your quiz grade, your quizzes will be worth 23% and your final exam 16%).

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	95 %	90 %	85 %	80%	75%	70 %	65 %	60%	55%	50 %	45 %

Poster Presentation

Posters will be completed and graded as a group based on content, appearance, and your presentation at the poster session. Poster preparation and printing will be the responsibility of each group and can be printed as a full 3'x4' poster at a print shop such as InSource or the on-campus Print Shop (costing roughly \$50 per poster), made by hand, assembled from several smaller sheets of paper (eg. letter-size), or other methods approved by the instructor. The chosen printing method will not affect the poster grading. Your final poster grade will include a peer evaluation component.

COVID-19 Update: Following the course moving online, the poster presentation will now be completed online by submitting a digital poster and a short video or audio presentation. Physical printing will not be required.

4. **Missed Components Of Term Work:**

The University has suspended requirements for students to provide evidence for reasons for absences so please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations. Please let your instructor know immediately if you are ill and cannot meet the deadlines specified.

Missed Quiz

Students who miss a quiz for a valid reasons, will be granted an excused absence by the Instructor provided that alleged problems are supported in writing by a person in a position of authority. Students must notify the Instructor by submitting the form: "Missed midterm" (Folder: "Missed course components") to the D2L Dropbox: "Missed quiz" within 48 hours after the midterm. Once the claim is substantiated, the weight of the quiz will be distributed across the other quizzes and the final. Sleeping in, missing the bus, forgetting etc. are not considered legitimate reasons.

COVID-19 Update: Students who miss quiz #3 for a valid reason, including internet connectivity issues, should email their instructor as soon as possible. Written support or evidence by a third party will not be required.

5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

6. **Course Materials:**

Required Textbook(s):

Kenneth Krane, *Modern Physics*: Wiley, 4th edition, 2020.

Online Course Components: Tutorials, laboratory documents, and supporting lecture material will be posted on the course D2L website.

7. **Examination Policy:**

For all quizzes and examinations a non-communicating calculator is allowed. Otherwise, no additional aids are permitted.

COVID-19 Update:

- **Quiz #3 will be an online individual open book test, any calculator is allowed. Access to the quiz and submission will occur on D2L.**
- **The final exam will also be an online individual open book test, any calculator is allowed. The exam will take place between 09:00 and 13:00 Saturday April 25th. The exam will be a 2hr exam with an extra 2hr given in case any technical challenges are experienced. The exam will be accessible as a PDF on D2L at 09:00 April 25th. Students will write their solutions on paper (no printing required) and scan/photograph the pages and upload to D2L.**

Students should also read the Calendar, [Section G](#), on Examinations.

8. **Approved Mandatory And Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course.

9. **Writing Across The Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also Section [E.2](#) of the University Calendar.

10. Human Studies Statement:

Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

11. Reappraisal Of Grades:

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections [I.1](#) and [I.2](#) of the University Calendar
- b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

12. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see www.ucalgary.ca/wellnesscentre or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at [403-220-2208](tel:403-220-2208).
- d. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/ fabrication of experimental values in a report. **These are only examples.**
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- f. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accommodations-for-students-with-disabilities.pdf](#).

Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Physics & Astronomy, Dr. David Feder by email

phas.ahugrd@ucalgary.ca or phone 403-220-8127. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See [Section E.4](#) of the University Calendar.

- g. **Safewalk:** Campus Security will escort individuals day or night (See the [Campus Safewalk](#) website). Call [403-220-5333](#) for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.
- i. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](#) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](#) Email: sciencerep@su.ucalgary.ca. [Student Ombudsman](#), Email: ombuds@ucalgary.ca.
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.
- l. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

Additional Information

Course Description

The goal of this course is to survey some of the significant challenges physics encountered in the 20th century and the solutions and their applications. An emphasis is placed on the experimental observations that led to the development of quantum mechanics and special relativity.

Topics include: Special Theory of Relativity, Electromagnetic waves, Blackbody radiation, Photoelectric Effect, X-rays and Bragg Diffraction, Compton Scattering, Atomic Structure, The Bohr Model, Atomic Spectra, Applications of the Schrödinger Wave Equation, Radioactivity, Nuclear Stability, Nucleosynthesis, Structure of the Nucleus, Elementary Particles.

Tutorial Lectures

Throughout the term there will be eight special lectures which will have a mixed tutorial and lecture format. These will take place during the assigned lectures on Fridays (10:00 to 10:50) in ENC 70. The objective of the tutorial lectures is to give you an opportunity to work in a supported environment to solve problems related to the course material. A set of problems will be posted on Monday prior to the tutorial. At the end of the session, you will hand in one or two problems (indicated on the question sheet) to be graded. These will count towards the Tutorial component in the course.

Quizzes

There are three quizzes throughout the course scheduled for Friday January 31st, Friday February 28th, and Friday March 20th from 10:00 to 10:50 in ENC 70. Quizzes are closed-book and you may only use non-communicating calculator and the equation sheet provided.

COVID-19 Update: Quiz #3 will be an online individual open book test. Access to the quiz and submission will occur on D2L.

Laboratory

Students are required to purchase a **blue lab notebook** from the University bookstore. The laboratory component of Phys229 is an essential opportunity for you to experience some of the exciting phenomena encountered in this course. Laboratory manuals will be available on D2L. Each laboratory exercise is accompanied by Pre-lab Questions. You must read over the laboratory exercise and complete these questions prior to entering the laboratory and working on the experiment. Your TA will check that these questions are complete at the start of the session. The laboratory exercises begin the week of January 20th and take place in ST 029. After the Reading Break, you and your group will select five experiments from a list of eight. One of the experiments must be chosen from Compton Scattering, Rutherford Scattering, and Nuclear Decay. Your laboratory TA will work with you to make the selection and coordinate when you perform an experiment. Note that the Nuclear Decay and Rutherford Scattering experiments require at least 24hrs to complete and a limited amount of time outside of your scheduled laboratory section may be needed to complete each experiment. Your group will submit one laboratory report for each of the five experiments completed after the Reading Break. The grading criteria and format for the laboratory reports will be discussed in the lectures. Your laboratory grade will include a peer evaluation component.

Laboratory Schedule:

Week	Name
Jan 20 th - Jan 24 th	Radioactive Decay
Jan 27 th - Jan 31 st	Electron Diffraction
Feb 3 rd - Feb 7 th	Evidence for Quantized Energy Levels
Feb 10 th - Feb 14 th	Hydrogen Balmer Series
Feb 17 th - Feb 21 st	Reading week, no labs
Feb 24 th - Feb 28 th	Rotating experiments, choose 5 of 8 from:
Mar 2 nd - Mar 6 th	Planck's Constant with LEDs
Mar 9 th - Mar 13 th	Black Body Radiation
Mar 16 th - Mar 20 th	Colour Temperature
Mar 23 rd - Mar 27 th	Compton Scattering*
	Faraday Effect
Mar 30 th - Apr 3 rd	Nuclear Decay*
	Photoelectric Effect
	Rutherford Scattering*

* Starred labs must make up 1 of the 5 choices.

COVID-19 Update: Any labs not completed before the course moved online will be completed as a report using sample data provided to the students.

Poster Presentation

You and your group will select one laboratory experiment or class-related reading topic to present in the form of a poster during a Symposium on Experiments in Modern Physics that will be held at the end of the term. The poster presentation will last approximately two hours, during which time you and your group members will discuss your results and conclusions with your peers and other members of the department. Laboratory TAs, the course instructor, and other volunteers will grade your work and your responses to questions. Strategies for designing an effective poster as well as the criteria for grading will be discussed in the lectures.

Lecture Schedule

Below is the tentative lecture schedule, including dates for the tutorials and quizzes.

Lec #	Date	Content	Text Section
1	13-Jan	Galilean and Lorentzian Transformations	2.1, 2.2, 2.5
2	15-Jan	Einstein's Postulates, Length Contraction, Time Dilation	2.3, 2.4, 2.5
3	17-Jan	Uncertainty, Tutorial #1	
4	20-Jan	Relativistic Energy and Momentum Equations	2.7
5	22-Jan	Relativistic Energy and Momentum Conservation	2.8
6	24-Jan	Tutorial #2	
7	27-Jan	Planck's Blackbody Radiation	3.3
8	29-Jan	Einstein and the Photoelectric Effect	3.2
9	31-Jan	Quiz #1	
10	03-Feb	Bragg Diffraction, Compton Scattering	3.1, 3.4
11	05-Feb	Rutherford Scattering	6.1 - 6.3
12	07-Feb	Tutorial #3	
13	10-Feb	Bohr's Postulate and the Bohr Model	6.4 - 6.8
14	12-Feb	de Broglie Matter Waves	4.1 - 4.3

15	14-Feb	Tutorial #4	
	17-Feb	Reading Break	
	19-Feb	Reading Break	
	21-Feb	Reading Break	
16	24-Feb	The Born Postulate, Probability Densities, Wave Packets	4.5 - 4.6
17	26-Feb	Expectation Values	
18	28-Feb	Quiz #2	
19	02-Mar	Position, Momentum, and Energy Operators	
20	04-Mar	Heisenberg Uncertainty Principle	4.4
21	06-Mar	Tutorial #5	
22	09-Mar	The Schrödinger Wave Equation	5.1 - 5.3
		One dimensional infinite potential well, Eigenfunction,	5.4
23	11-Mar	Eigenvalue	
24	13-Mar	Tutorial #6	
25	16-Mar	Normalization, Expectation Values	5.4
26	18-Mar	Harmonic Oscillator, Potential Barriers and Unbound States	5.5, 5.6
27	20-Mar	Quiz #3	
28	23-Mar	Tunneling	
29	25-Mar	Hydrogen atom and Orbital Angular Momentum	7.1 - 7.3
30	27-Mar	Tutorial #7	
31	30-Mar	Radial Probability Density	7.4 - 7.5
32	01-Apr	Zeeman Effect, Stern-Gerlach, Spin Angular Momentum	7.6 - 7.9
33	03-Apr	Tutorial #8	
34	06-Apr	Radioactivity and Nuclear Decay	12.1 - 12.6
35	08-Apr	Alpha, Beta and Gamma Decay	12.7 - 12.9
36	15-Apr	Poster Presentations	

Course Incomes

Physics 229 will introduce many new concepts and requires knowledge of classical mechanics and some knowledge of electromagnetism. This course will use calculus extensively so students should be comfortable with differentiation and integration as well as vectors.

Electronically Approved - Mar 19 2020 11:17

Department Approval

Electronically Approved - Mar 19 2020 16:52

Associate Dean's Approval for alternate final examination arrangements or remote learning and out of regular class-time activity