University of Texas at Tyler
CHEM 3352: Physical Chemistry I
Fall 2023

Table of Contents

Contact Information

Instructor:
Dr. Rachel Mason

- rmason@uttyler.edu
- 903/565-5641
- RBS 3002

Office Hours:

- MWF 9:00-10:00 am
- MW 4:00-5:00 pm
- By appointment. Please email to set-up an in-person or Zoom meeting.
- I have an open door policy welcoming drop-ins when I am available.
- I expect you to have questions so be sure to ask them.

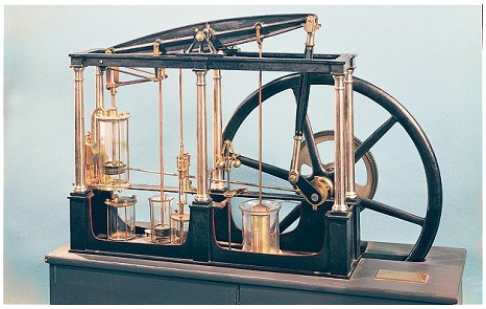
Course Description

Physical Chemistry is the quantitative and theoretical study of the properties and structure of matter. The aim of this course is to give the student an understanding of the principles, laws and theories of physical chemistry that will serve the needs of the chemistry, biochemistry, premedical and engineering student.

Physical chemistry is typically grouped into four main topics:

- Thermodynamics – Dealing with the interconversion of various kinds of energy and the changes in physical properties that are involved.
- Kinetics – Dealing with the rates of chemical processes.
- Quantum Mechanics – Dealing with phenomena on the molecular level
- Statistical Mechanics – Connecting the properties of individual molecules with bulk properties.

This course, as the first of a two semester sequence, is concerned with the first two topics.



Student Learning Outcomes

By the end of the course the students should be able to:

- Thoroughly understand and apply principles, laws and theories of introductory physical chemistry.
- Solve quantitative and qualitative problems.
- Use original thought and logic in solving complicated problems.
- Learn and work independently.
- Work cooperative with others.

Meeting Times & Dates

The course will meet in-person on Tuesdays and Thursdays from 11:00 am-12:20 pm from 22 August to 5 December 2023 in RBS 2015 unless otherwise noted.

Class will not meet at all during the Thanksgiving break (22-26 Nov). The Career Success Conference will be Thursday October 19th. This course will not meet on that day. Students are encouraged to utilize the Conference around their regularly scheduled classes.

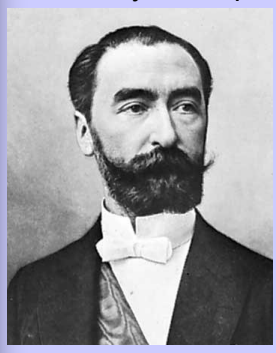
Important Dates

Administrative Dates to Know:
September 1st (Fri) – Last day to file for grade replacement; last day to enroll
September 4th (Mon) – Labor Day holiday, no classes held
October 1st (Sun) – Final deadline to file for Fall 2022 graduation
October 30th (Mon) – Last day to drop or withdraw from courses with a W
November 1st (Wed) - Spring Enrollment opens for Seniors
November 20th–24th (Mon-Fri) Thanksgiving Break, no classes

Test Dates:
Regular Exams: 1) Sep 19th 2)Oct 17th 3)Nov 16th
Regular exams are held during the class period and may be followed by a take home exam.

Final Exam: December 5th (Tuesday) from 11:00 am – 1:00 pm

Ecole Polytechnique

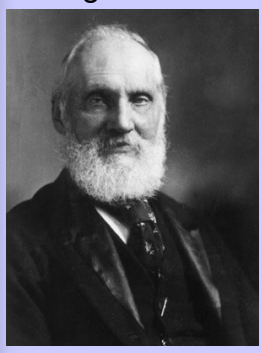


Sadi Carnot
(1796-1832)

Physical Chemistry:

The pitiful attempt to apply $y = mx + b$ to everything in the universe

Glasgow School

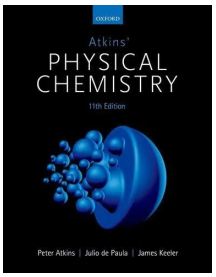


William Thomson
(1822-1888)

Instructional Materials

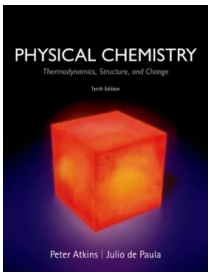
Required textbook is either:
Atkins' Physical Chemistry by Atkins, de-Paulo & Keeler
ISBN: 978-0198769866

Atkins' Physical Chemistry: Thermodynamics, Structure and Change by Atkins, de-Paulo & Keeler
ISBN: 978-1429290197
(e-books ok too)



The coursemap for this particular text is found under the Atkins et. al link.
Students are encouraged to utilize outside resources to help learn. Some useful (free) channels are:
MIT OCW PChem
PCHEM CWU
TMP Channel Thermo

Students should also be aware of the Chem LibreText website (https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps) which contains coursemaps relating free OER text resources to published textbooks.



Additional materials may be posted on the course's Canvas page.

Additional Supplies: Students will need a scientific calculator capable of doing logarithms & exponentials.

Pre-requisites and Co-requisites

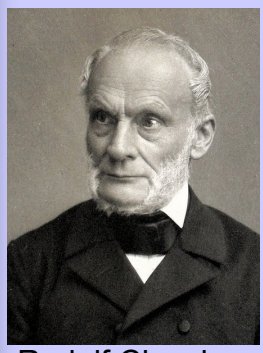
Prerequisites for the course are: Calculus I & II, University Physics I and II (calculus based), General Chemistry I & II, Organic Chemistry I and Analytical Chemistry. Students are strongly encouraged to have credit for or be concurrently enrolled in Calculus III: Multivariate Calculus.

Chem 3153: Physical Chemistry I Laboratory (1 semester hour credit) should be taken concurrently with this course. A student cannot use this lecture as part of the degree requirements without the corresponding laboratory course or the Chair's permission to do otherwise.

Tentative Course Schedule

Chapter 1: Properties of Gases KMT, Perfect Gases, Real Gases	Week 1
Chapter 2: First Law of Thermodynamics Internal Energy, Enthalpy, Thermochemistry, State Functions, Adiabatic Changes	Weeks 2-3
Chapter 3: Second & Third Law of Thermodynamics Entropy, Helmholtz Energy, Gibbs Energy, Combining Laws	Weeks 4-5
Chapter 4: Physical Transformations & Pure Substances Phase Diagrams & Phase Transitions	Weeks 6-7
Chapter 5: Simple Mixture Thermodynamics, Properties of Solutions, Binary Systems, Ternary Systems	Weeks 8-9
Chapter 6: Chemical Equilibrium Equilibrium Constants, Response to Change, Electrochemical Cells	Weeks 10-11
Chapter 17: Chemical Kinetics Rates of reactions, Integrated Rate Laws, Equilibrium Reactions, Arrhenius Equation, Mechanisms	Week 11-12
Chapter 18: Reaction Dynamics Collision Theory, Transition State Theory, Collision Dynamics, Electron Transfer	Week 13
Chapter 19: Processes at Solid Surfaces	Week 14

Berlin School



Rudolf Clausius
(1822-1888)

Grading

Grades will be tentatively based on a 90/80/70/60 scale, but may be adjusted on my evaluation of the class.

Exams scores will be the percentile grade received on each exam.

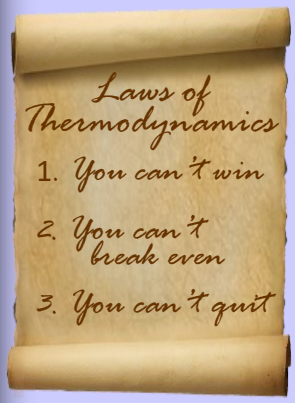
Homework/Quiz/Response grade will be the cumulative percentage score for all assignments.

Course grade will be determined by:

Homework, Class Work & Quizzes	20%
Regular exams	60%
Final exam	20%
Total	100%

Examinations

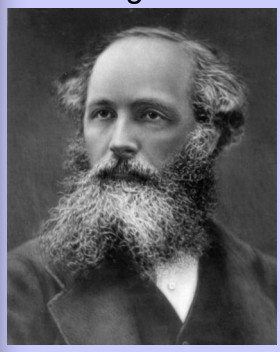
- **Exams are comprehensive.** All exams are comprehensive, but material covered since the previous exam will be emphasized most heavily. Material discussed during class periods, assigned homework & guided inquiry modules and other assigned materials, including material in assigned readings, but not directly discussed during class periods are fair game for the exams. Any exceptions will be announced in class.
- **Exams may have two parts.** There will be an in-class portion of the exam and an take home portion. In some parts students will be expected to work cooperatively in teams on portions of the exams.
- **In-class exams are closed-book.** Students should bring a pencil, an eraser and a scientific calculator. Students are also allowed one hand-written 3 x 5 inch note card.
- **Take-home exams are open-book and open-note.** Students are allowed to consult the textbook, course notes and me during the course of take home exams. <u>All other resources are prohibited.</u>
- **Make-ups are rare.** Make-up examinations will be given ONLY for excused absences and should be scheduled in <u>advance</u> of the exam. Notice of such absences should be given <u>well in advance</u> of the exam. Except in extreme situations, no exam will be given after its scheduled date.
- **The final is a requirement.** All students are required to take the final examination in order to receive a passing grade in the course.



Homework & Responses

- **There is lots of it.** Learning Physical Chemistry requires study, practice and drill. Homework will be assigned roughly once a week.
- **You need to do it.** Students are expected to complete all assigned homework sets, these sets/problems even though not all problems will be graded. Those don't do the homework generally don't do well.
- **It looks like the tests.** It is to the student's advantage to work all problems since homework problems & exam questions will be similar.
- **Some of it is graded.** Students will receive a grade based on the percentage of an assignment completed. In addition, selected problems of each assignment will be graded for correctness.
- **It involves thinking and writing.** Short reflective writing assignments requiring critical thinking occur during class and others are to be completed outside of class.

Edinburgh School

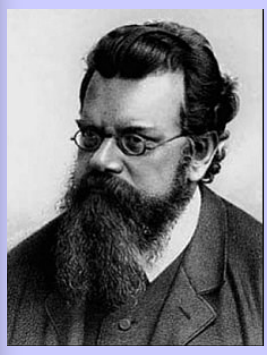


James Maxwell
(1831-1879)

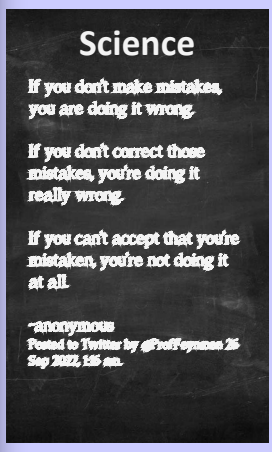
Quizzes & In-Class Problems

- **Quizzes are unannounced.** Quizzes may be given on random days (usually during the first 5-10 minutes of class). Students not taking the quiz will receive a zero.
- **Quizzes cover previous material.** Quizzes are technically comprehensive, but will focus on the material covered in the preceding 1-2 lectures.
- **In-Class problems.** Some lectures will include problems to be worked during class. Selected in-class problems will be taken up for a grade.

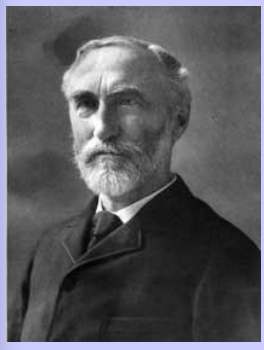
Vienna School



Ludwig Boltzmann
(1844-1906)



Gibbsian School



Willard Gibbs
(1832-1903)

Success Strategies

- **Come to class.** Attendance is extremely important to success in PChem, as it is imperative to keep up with the course material as the semester progresses. Each lecture builds on the previous. Class participation and attendance will not be graded *per se*, but will be considered in the final grade.
- **Be prepared.** The course material is difficult to read and requires time to "sink in." It will be much more comprehensible if the text is read both before and after lecture.
- **Take good notes.** Students should take adequate lecture notes and review them after lecture. Consult me about points that seem unclear as soon as possible.
- **Spend time studying.** Let us just be up front about this: PChem will be a time consuming course. Expect to work hard and spend many hours outside of class studying & working problems. It may be tempting to skip it. DO NOT do so.
- **Do not cram.** It is NOT advisable to wait until immediately prior to an exam to seek help. Rather, visit me early & often to keep up with the material.
- **Pool your knowledge.** Students are strongly encouraged to form cooperative learning groups in order to help each other learn and to encourage each other. This allows students to share their knowledge and to take advantage of the talents of others surrounding them.
- **Ask questions.** Ask questions in class, ask question in my office, ask questions in lab, ask questions in the hall, ask questions by email, ask questions by phone, ask questions by facebook—just ask them. When you don't get something, ask.
- **Do not cheat.** Students are encourage to study and prepare for exams with other students. Students are expected to work alone on examinations. **Cheating will not be tolerated.** University regulations contained in *A Student Guide to Conduct and Discipline at UT Tyler,* are explicit about academic dishonesty and will be enforced. These may be obtained in the Office of Student Affairs or accessed at http://www.uttyler.edu/mainsite/conduct.html. During examinations, an honor code will apply such that students are to work alone and neither give nor accept help to/from others. Students are expected to help enforce the code.

Career Success Conference

Thursday October 19th from 8:00 am to 5:00 pm all students are invited to attend the Career Success Conference. Current students have the opportunity to engage with industry leaders and alumni to learn how to build and develop core traits of career success.

#UTTylerCSC

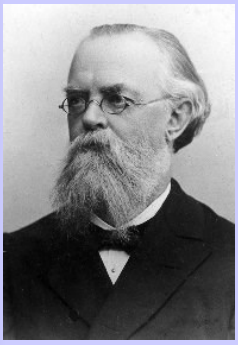
A complete schedule is available at: https://csc.uttyler.edu/. Unfortunately this is during our class & lab so opportunities to participate may be limited. Students are strongly encouraged to attend the events they can. Students not in lab are encouraged to attend afternoon sessions.

Student Resources

The following are resources available to UT Tyler students. Many of these offices provide additional programming throughout the academic year.

- Student Counseling Center (www.uttyler.edu/counseling or 903566-7254)
  Confidential dealing with stress/anxiety, improving study skills, time management, *etc*
- UT Tyler Student Health and Wellness (www.uttyler.edu/wellness)
  Substance abuse, household violence, good eating habits, etc.
- Academic Success (www.uttyler.edu/success or 903/565-5964 or tutoring @uttyler.edu)
  Supplemental Instruction (SI), Student Learning Communities (SLC), and the tutoring center.
- The Writing Center (www.uttyler.edu/writingcenter)
  Helps you learn how to write better. 903/565-5995 writingcenter@uttyler.edu
- The Mathematics Learning Center, RBN 4021
  Computer Lab with tutors to assist students enrolled in early-career courses.

Dresden School

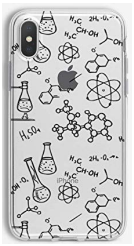


Gustav Zeuner
(1828-1907)

Academic Integrity

The value of any academic degree depends upon the integrity of the work done in earning the degree. Academic misconduct includes, but is not limited to cheating, plagiarism, collusion and/or falsification of records (including data collection). Students are expected to assume full responsibility for the content and integrity of all academic work submitted as homework, classwork, quizzes, responses, projects and examinations. Students are expected to conduct themselves honorably by neither giving nor receiving unauthorized aid on exams. University policy obliges instructors to report cases of academic misconduct to the Dean of Students; it also obligates students to report observed instances of academic dishonesty to the instructor. As upper division students, I expect an extremely high level of responsibility and academic honesty from my PChem students.

Departmental Cell Phone Policy



The Departmental Policy on Cell Phones states: Cell phones and smart watches/ electronic devices must be put away during exams. If they are observed out in a visually accessible place (*i.e.* between legs, on the floor, *etc.*), it will be assumed that they are being used to cheat and your exam will be taken, you will receive a zero score (0 points) for the exam, and you will be referred to the Office of Judicial Affairs. Lets just avoid this.

Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

Classroom Courtesy

Even though this is not a large class small disruptions add up quickly. The course has ample opportunity for discussion and students are encouraged to actively participate at those times. I expect students to behave with respect and courtesy to both the instructor and fellow students. This includes:

- **Deactivating/silencing all cell phones, tablets, *etc* during class.**
- **Not texting or calling during class.** If you absolutely must take a call, please leave class or mute your microphone as is appropriate.
- Using of electronic devices responsibly. While you may use your tablet, *etc* to take notes, please don't work, play games or have non-class related chat.
- Refraining from derogatory remarks and profanity in class.
- Not talking during class presentations or over top of another person during discussions.

Special Considerations for In-Person Classes:

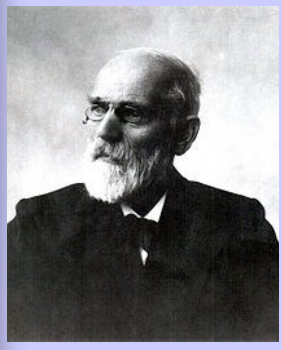
- If you must arrive late or leave early please do so with minimal disruption.
- Please don't chat with to your neighbor. Even in a small class "whispering" becomes loud when enough people are doing it.

Special Considerations for Online Classes:

- Please mute your microphone unless you are actively speaking as unexpected background noise can be disruptive to everyone.
- I realize you are at home, but please treat online attendance with the same respect you would in person class.

- You would not come to an in-person class in only your undergarments or without a shirt so please do not appear on video without appropriate clothing. As far as it is within your control please enforce this with any other people within the frame of your webcam.
- You would not perform deeply personal activities in an in-person class so please refrain from doing so with on Zoom.

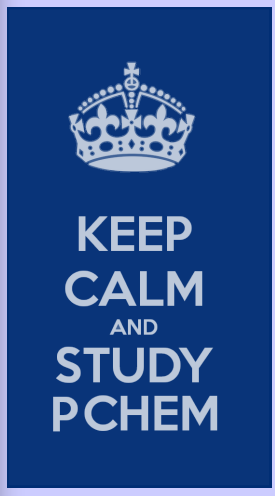
Dutch School



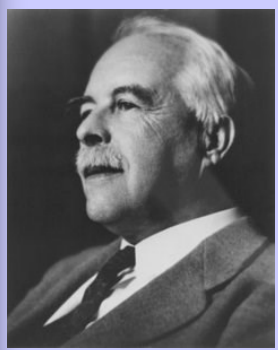
Johannes van der Waals
(1837-1923)

Energetics School

Wilhelm Ostwald
(1853-1932)



Lewis School



Gilbert Lewis
(1875-1946)

Handling Illness

In-Case of Illness

Students who are feeling ill or experiencing symptoms such as sneezing, coughing, digestive issues (e.g. nausea, diarrhea), or a higher than normal temperature should stay at home and are encouraged to stay home.

Health Hygiene & Self Care

Students are reminded that the spread of most communicable diseases can be reduced by using good health hygiene practices such as covering coughs and sneezes, frequent hand washing, surface cleaning and staying home when ill. Students are further encouraged to maintain a healthy immune system through practicing good self-care. College is stressful enough without getting sick!

Additional Accommodation

Students needing additional accommodations due to illness may contact the Office of Student Accessibility and Resources at University Center 3150, or call (903) 566-7079 or email saroffice@uttyler.edu.

COVID Mitigation

Students who suspect they have been exposed to or tested positive for COVID should follow the UT Tyler COVID-19 Information and Procedures.

UT Tyler guidelines for COVID mitigation will be followed. Should the University mandate remote learning this class will shift to an online format. It is anticipated that will be Zoom sessions at the scheduled course time. Details will be provided on the course Canvas page in this event.

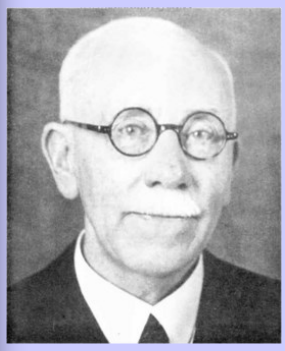
Course Format

This is an in-person class. It is anticipated that all class sessions will be held in–person. However, it may become necessary to hold a few classes remotely in case of illness, travel or other unanticipated events. In such cases, students will be notified by email and via Canvas announcement. At this time, I do not anticipate regularly recording class sessions for posting at a latter date. So please plan to be present for each class session.

Class Recordings

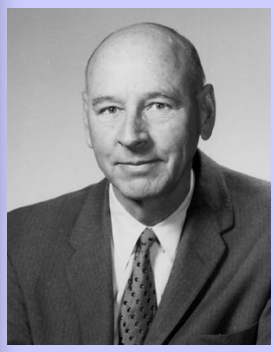
While I am not planning to record sessions regularly, class sessions **may** be recorded by the instructor for use by students enrolled in this course. Recordings which contain personally identifiable or other information subject to the FERPA guidelines shall not be shared with individuals not enrolled in this course unless appropriate consent is obtained from all relevant parties. Class recordings will be posted to the course Canvas page. They are reserved **ONLY** for the use of students enrolled in this course and are for educational purposed only. Course recordings should not be shared outside of the course without express written permission of the instructor. Students who know they will miss class should communicate with me as soon as is practical to ascertain whether or not recording the session will be an option. Recordings will not be available as a substitute for regular class attendance.

Brussels School



Theophile de Donder (1872-1977)

MIT School



Joseph Keenan (1900-1977)

University Policies Highlights

UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php

Campus Carry

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at http://www.uttyler.edu/about/campus-carry/index.php

UT Tyler a Tobacco-Free University

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors. Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products. There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit www.uttyler.edu/tobacco-free.

Grade Replacement/Forgiveness and Census Date Policies

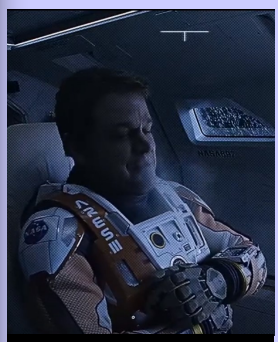
Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar. Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date). Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.



I will be slowly killed by the laws of thermodynamics.

- Matt Watney in "The Martian

The Martian; Scalia, P., Ed.; Twentieth Century Fox : United States,

University Policy Highlights, Continued

Disability/Accessibility Services

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.

Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

Social Security and FERPA Statement

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

Emergency Exits and Evacuation

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

In this house, we obey the laws of thermodynamics.
- Homer Simpson
The Simpsons S06E21
14 April 1995.

Silly PChem Memes Pirated from the Internet to Use this Space