



# GEL4250 Hydrogeology (Groundwater) Syllabus

FALL 2016

Meeting: Sec.001 - 54084: MW 11:00 - 1:15pm Room: SI2012  
 Professor: Uwe Richard Kackstaetter, Ph.d. (Dr. "K") Office: SI2025  
 Office Hours: Office Hours: M, T, W 10:00-11:00am; T 2:00-4:15pm; Other times by appointment!  
 Contact: E-mail: [kackstae@msudenver.edu](mailto:kackstae@msudenver.edu) Phone: 303-556-3070 URL: <http://college.earthscienceeducation.net>

**This syllabus may be modified at any time without prior notice.**

## Course Description

This course is a practical approach to the study of groundwater with emphasis on water quality, underground flow, pumping, and infiltration / recharge principles in relationship to the geologic environment. The course includes practical methods of laboratory water quality testing, groundwater flow analysis and experimentation, as well as septic system design and evaluation. Since mathematical models are involved, familiarity with graphing and algebraic operations is of essence. A foundational knowledge in geology is prerequisite. Self-guided group fieldtrips are required for this course..

**Prerequisites:** GEL1010, CHE1800, MTH1110

## Required Materials

- Fetter, C.W., 2001, Applied Hydrogeology; 4<sup>th</sup> edition, Pearson, ISBN-13: 9780130882394.
- Scientific Calculator (NO CELL PHONE CALCULATORS ALLOWED)
- i-clicker (ABSOLUTE MUST! YOUR GRADE DEPENDS ON IT)

## Specific (Measurable) Student Behavioral Learning Objectives

Upon completion of the course the student should be able to:

- Assess basic water chemical & physical parameters;
- Distinguish between confined & unconfined aquifers from data;
- Draw groundwater flownets to scale from provided data;
- Apply Darcy's Law to groundwater flow and geological material interpretation;
- Use and interpret pumping data for groundwater flow applications;
- Plot and interpret Ternary, Piper, Stiff, Durov, Schoeller and Ion-Balance Diagrams for water quality analysis.
- Use proper sampling & water analytical techniques for water quality analysis.
- Examine a field site and assess its suitability for installing a septic disposal system.

## Outline of Course Content

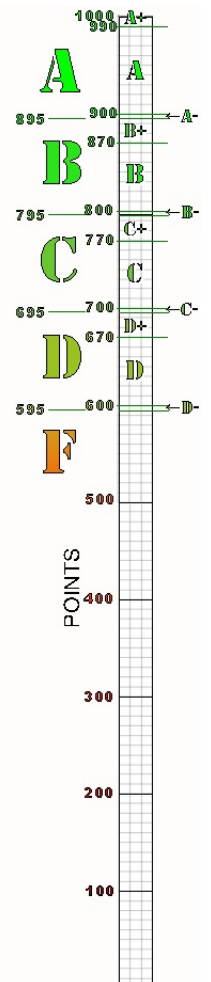
### Major Topics & Subtopics

- Water Physics & Chemistry
- Soil & Rock Science of Porosity, Permeability, Density
- Groundwater Flow, Darcy' Law
- Pumping Aquifers
- Intro to Hydrochemistry
- Hydrochemical Sampling & Analytical Procedures
- Groundwater Water Quality

## Grading

	Max. Points
Participation	100
LAB Accuracy TEST	100
Basic Math Skills Exam Basic Chemistry Skills Exam	50 (25pts ea.)
4 LABS: Hydrochem Lab 1; Porosity & Permeability Lab 2; Flownets Lab 3; Aquifer Pumping Lab 4	100 (25pts ea.)
Water, Permeability & Porosity Exam Aquifer Pumping Concepts & Calculations Exam Hydrochemistry Concepts & Calculations Exam	300 (100pts ea.)
Manitou Springs Geochemical Data Graphing	150
Groundwater Percolation Test & Report Project	200
<b>TOTAL</b>	<b>1000</b>

**FINAL GRADE:** A+ > 990 A = 900-990 A- = 895-899 B+ = 870-894 B = 800-869 B- = 795-799  
 C+ = 770-794 C = 700-769 C- = 695-699 D+ = 670-694 D = 600-669 D- = 595-599  
 F = ≤ 594 points





**WARNING! WARNING! WARNING! WARNING! WARNING! WARNING! WARNING! WARNING! WARNING! WARNING!**  
**I reserve the right to DROP any student from the course who does NOT show up for our first or second class meeting!**  
**(Unless you have made special arrangements with me IN WRITING first). YOU HAVE BEEN WARNED!**

**GRADING / ASSESSMENT OVERVIEW, SCHEDULE, and HARD DEADLINES**

*Note: M or W dates are for MW classes, T or R dates are for TR classes. F and S dates and date spans designated by "through" are for ALL sections, MW as well as TR.*

Assignment / Assessment	Delivery Method	Restrictions / Notices	Total Points	Date / Deadline
I-clicker Participation	Random in-class quiz questions related to lectures. Grade is cumulative throughout the semester.	Students need to purchase an I-clicker NO make-up / retake possible.	100 [~3.3 pts/day]	Daily
Micro Exam: Basic Math Skills Exam Basic Chemistry Skills Exam	In-class examination covering required prerequisites for the course	Closed book / notes exam. NO retake possible. Make-up only with doctor's note! Can be reviewed after grading by appointment	50	Monday, August 29, 2016  Tuesday, August 30, 2016
Hydrochem Lab 1	Laboratory assignment.	No late work accepted.	25	Friday, October 7, 2016
HYDROCHEMISTRY CONCEPTS & CALCULATIONS EXAM	In-class practical examination of water chemistry and associated lab measurements.	Closed book / notes exam. NO retake possible. Make-up only with doctor's note! Can be reviewed after grading by appointment	100	Monday, October 24, 2016  Tuesday, October 25, 2016
Porosity & Permeability Lab 2	Laboratory assignment.	No late work accepted.	25	Friday, November 11, 2016
WATER, PERMEABILITY, POROSITY EXAM	In-class practical examination of water physics, lithologic permeability and porosity and associated lab measurements..	Closed book / notes exam. NO retake possible. Make-up only with doctor's note! Can be reviewed after grading by appointment	100	Wednesday, November 16, 2016  Thursday, November 17, 2016
MANITOU SPRINGS GEOCHEMICAL DATA GRAPHING	Comparative graphing assignment of natural springs	For exact details see the project rubric and description	150	Monday, November 28, 2016
LAB ACCURACY TEST	Determine the sulfate, bicarbonate, and electric conductive of an unknown water sample using any method you like.	Closed book / notes exam. NO retake possible. Administered to <b>last names A - M</b>	100	Monday, November 28, 2016
				Tuesday, November 29, 2016
				Wednesday, November 30, 2016
				Thursday, December 1, 2016
GROUNDWATER PERCOLATION TEST REPORT	Percolation test project and septic field design. Students are required to analyze field data and compile a professional report of their findings.	For exact details see the project rubric and description and explanation of the 3 deadlines.	200	"A"-Deadline Friday, November 11, 2016
				"B"-Deadline Monday, November 28, 2016
				"C"-Deadline



Assignment / Assessment	Delivery Method	Restrictions / Notices	Total Points	Date / Deadline
				Monday, December 12, 2016
Flownet Lab 3 Aquifer Pumping Lab 4	Laboratory Assignments.	No late work accepted.	25 25	Monday, December 12, 2016
AQUIFER PUMPING CONCEPTS & CALCULATIONS EXAM!	In-class and hands on exam covering analysis of pumping data from various wells.	Closed book / notes exam. NO retake possible. Make-up only with doctor's note! Can be reviewed after grading by appointment	100	During Finals Week: TBD
<b>TOTAL POINTS</b>			<b>1000</b>	

**PARTICIPATION:** You are EXPECTED to attend class & labs and PAY ATTENTION in both. Attendance & Student Responses will be tracked using the I-clicker interactive student response system. The timely purchase of the device is REQUIRED in order to earn full participation points (see point distribution below). If you forget your clicker or do not have one (NOT recommended), you MUST sign a special roll in order to receive at least partial credit for attending class (Lowest score of the day minus 10%). **Points can NOT be assigned retroactively !!!** Students can earn daily points toward their participation grade by responding CORRECTLY to i-clicker questions randomly presented during lectures / labs. I absolutely DESPISE students with less than 80% participation, whining about their grade at the end of the semester. (So, don't even try!). In regards to attendance & class materials: Any handout, any notes, any exam questions discussed will only be given IN CLASS. If you miss class, you are on your own. I do not keep extra copies and NO, I do not have or publish lecture notes for your convenience! (THIS NOT AN ONLINE CLASS!)

**Point Distributions:**

15 Week Course meeting	(a) twice per week: 3.3pts/day	(b) once per week: 6.6pts/day
10 Week Course meeting	(a) twice per week: 5pts/day	(b) once per week: 10pts/day
8 Week Course meeting	(a) twice per week: 6.25pts/day	(b) once per week: 12.5 pts/day

**ABSENCES:** Frankly, registering for this course is equivalent and as serious as you taking a job. I expect from you the same professional courtesies that you would extend toward your employer. As with any employer, you do NOT get paid for missed days, meaning, there are NO participation points awarded if you do not show up for class. Period! However, similarly to the real employment world, I will grant you "sick or leave days" worth a total of 10 participation points, which you may use at your digression. As with most employment situations, you may "cash in" your remaining "sick or leave days" for extra credit at the end of the semester. Absences beyond these allotted points will never be awarded anything, no matter the reason, including but not limited to illness, work conflicts, car accidents, booked vacations, etc.

*Exception: Jury-Duty: You must bring official proof of your actual court room duty validated by the court / judge! (No, the little card you get in the mail soliciting you for jury duty does NOT count!)*

**Note: Nothing in this policy shall require the instructor to reschedule classes, repeat lectures or other ungraded activities or provide ungraded individualized instruction solely for the benefit of students who are unable to attend regularly scheduled classes or activities.**

**HYDROGEOLOGY EXAMS:** These exams are in-class exams and are generally closed book / closed note exams. Equations, conversion factors, and tables are usually provided with the exam.

**Disclaimer:** We will NOT be able to cover everything in every chapter during class due to time constraints. Some questions in these Exams are Fetter Questions from the book, not necessarily covered during lectures.

**EXAM or TEST MAKE-UP:** Make only possible with proper documentation. Just missing the exam doesn't count.

**FIELD TRIPS:** You will be required to take a self-guided group fieldtrip to Manitou Springs, Colorado to obtain and analyze some water samples for the Manitou Springs Geochemical Data Graphing.

**LATE WORK:** Since all labs and other assignments are available within the first few weeks of class, I will not accept ANY late work. **Please note, this means ANY!!!** You had practically the whole semester to complete the exercise(s), so don't blame broken printers, crashed computers, uncooperative emails, sudden work conflicts or bouts of illness the day(s) before or even during the deadline for missing the deadline. *Hint: Turn your work in early and there will be NO problems!* Since the last deadline is always the last day of your regular scheduled class for the semester, **there will be absolutely NOTHING accepted during and after Finals Week! Don't even try!**

**EXTRA CREDIT:** Extra credit for the Project is included in the project packet. Many exams / assignments also include approx. 10% extra credit, giving students the opportunity to earn a high score of 110%. NO OTHER ADDITIONAL EXTRA CREDIT WILL BE GIVEN. So please DON'T ask.



**CIVILITY:** The student code of conduct will be enforced in this class. The short version of the code: Students are expected to assist in maintaining a classroom environment conducive to learning and respectful of the instructor and fellow students. Students have an opportunity to gain from time spent in class. Therefore, students are prohibited from using cell-phones or beepers, text messaging, eating or drinking in class, making offensive remarks, reading newspapers, using their laptop or PDA for class unrelated activities (such as browsing the internet, checking email, watching videos, etc.) or doing other assignments unrelated to the class, sleeping or engaging in any other form of distraction. While you may feel that you are doing it quietly and unobtrusive enough, it does indeed distract other students (as scores of them have reported to me). Inappropriate behavior shall result minimally in a request to cease the behavior and upon continuation despite warnings to leave the class.

**ELECTRONIC DEVICES:** Put ALL your consumer electronics away (which means they are NOT to be visible, even if you don't use them) including but not limited to cell phones, ipods, MP3 players, headphones, etc. They are NOT to be used at any time during my class. Cell phone calculators are NOT ALLOWED, you must bring a "real" calculator. Personal computers are allowed in class only with approval from the instructor and a written and signed contract. Permission for use of PCs will be immediately revoked for the remainder of the course if a student is found to be engaged in unrelated activities, such as checking e-mail, surfing the web, playing games, etc. Texting, emailing, gaming, listening to music or similar unrelated activities during classtime is not only rude and unprofessional, it is highly annoying to me and the majority of your fellow students. If you are caught you will be unceremoniously asked to leave my class and you will lose any or all participation points for that day. Repeat offenders will face disciplinary action on the college level.

**You have been warned!**

**CELL PHONE WARNING:** There are NO cell phones allowed in the classroom! PERIOD! If you text or do anything with your cell phone, **Dr. K has the right to REMOVE YOU FROM THE CLASS. PERIOD!** First infraction will most likely involve a stern, public and very embarrassing warning. Continued infractions will result in a removal from the class and possible failing grades.

**LAB ASSIGNMENTS:** Lab assignments carry 25 points each (100 points total) and must be completed by the indicated deadlines.

**LAB TIME:** This class requires a lot of lab time. While some time for lab exercises will be given during the assigned lecture block, we have created an open lab schedule outside regular class periods. Please look carefully at the posted calendar and sign-up accordingly. Lab spaces are limited and sign-ups will be taken on a first-come, first-served basis. While you may sign-up for several lab times in advance, keeping these times is a crucial commitment. If you miss ANY of your appointments, ALL your future sign-ups will be bumped in favor of other students willing to keep their commitment. **You have been warned!** Also, be aware that certain labs are only set up during certain times. Missing these labs does not automatically qualify you for a lab make-up at a later date. In fact, these make-ups will be RARELY GRANTED and will need full **official** documentation of circumstances preventing a student from completing the lab during the assigned time slot. **You have been warned again!**

**LAB RULES:** All students working in the lab must sign in, state the purpose of their activities and wear an appropriate name badge identifying you legitimacy to be in the lab. Students must follow instructions of the Lab Assistants and are responsible for thoroughly cleaning their work space and lab equipment used after the completion of the lab exercise. **BE AWARE: LAB INFRACTIONS CONCERNING EQUIPMENT & CLEAN-UP CARRY MINUS POINTS FOR THE COURSE!** ALL students must read and sign the following Liability Waiver:

**LAB LIABILITY WAIVER**

- (1) Students in the course will use analytical instrumentation, chemical investigations &/or field assays, sometimes to be taken outside of the classroom. All students participating in such lab activities taught by the Department of Earth and Atmospheric Sciences should be aware that there is always an element of risk involved when working with equipment and/or chemicals. These risks involve serious injury or death, especially if safety protocols are not followed and/or equipment, machinery, and chemicals are misused. Instructors and/or Lab Personnel will use all reasonable precautions and students need to exercise prudent behavior during such activities, but even then there exists the possibility of an accident or injury. Since many of these activities are to be undertaken in the field and outside of the classroom without the direct supervision of an instructor, students must be alert and aware of possible risks and dangers when using chemicals, equipment, and/ or machinery with or without supervision.
- (2) Neither the University, nor the instructor, nor any assigned Lab Personnel shall be liable for any damages, including but not limited to injuries, death, loss of property or profits, or incidental, consequential, exemplary, special or other damages that may result from use of chemical, equipment, and/or machinery used in conjunction with or outside the framework of this college course. This condition also expands to the use of procedures and formulations given in LAB texts.
- (3) The associated LAB instructions and described analytical procedures are intended for use by persons with a basic knowledge of inorganic chemistry, they are advised to follow strictly the safety instructions. Neither the author, nor the instructor, nor the University does accept liability or responsibility for any injury or damage to persons or property incurred by performing the experiments described in the LAB manual, nor for the content of any outside material referred to in class or manual, including linked websites.
- (4) EXPLICIT SAFETY RULES & REGULATIONS:
  - I. Students MUST wear Safety Goggles when working with chemicals or using equipment or machinery.
  - II. Students MUST read and follow instructions precisely.
  - III. Students shall NOT misappropriate chemicals, equipment and/or machinery other than its intended and prescribed use.



- IV. Students must take care not to ingest, inhale, taste or otherwise orally contact chemicals or reactive products. Students **MUST** wash hands after each experiment.
  - V. Some tests may include open flames. Students **MUST** take precautions in hair and clothing to avoid accidental or intentional contact of persons and property with flames and fire.
  - VI. Students **MUST** take care when transporting equipment to avoid spillage and unintended contact with property and persons.
- (5) Students who violate any of the above rules, policies and stipulations which are written in this document or implied through instruction and professional laboratory behavior or who fail to conform to directives from the instructor or lab personnel **may be immediately dismissed from the course**. They may also be subject to a failing grade in the course, be required to withdraw from the course, and be subject to disciplinary action by the University.
- (6) All participants **MUST SIGN** the following **LIABILITY WAIVER**.

In consideration of my being permitted to participate in this activity, I, the undersigned hereby release and hold harmless: the Trustees of the Metropolitan State Universities of Denver, the Earth and Atmospheric Sciences Department, and respective employees, from all claims, losses, damages, or expenses because of property damage or personal or bodily injury incurred or caused by me during or in conjunction with the above mentioned activity or activities. In filling out this form, I acknowledge that I fully understand the risk that is inherent with on and off campus laboratory procedures and/or equipment and/or machinery use. The undersigned also indicate with their signature that they will follow appropriate safety rules and regulations. Furthermore, I have fully read and understand the department policies and my liability and do accept the restrictions.

#### Addendum to ACADEMIC INTEGRITY section below

**I-CLICKER:** Responding to i-clicker questions for someone else (e.g., by using their i-clicker together with your own) **CONSTITUTES ACADEMIC CHEATING** (same as cheating on a test or exam).

A few but not limited examples of academic dishonesty include cheating, fabrication, and plagiarism, submitting the same paper or work for more than one class, and facilitating academic dishonesty.



# COLLEGE OF LETTERS, ARTS, AND SCIENCES SYLLABUS POLICIES – Fall 2016

Students are responsible for full knowledge of the provisions and regulations pertaining to all aspects of their attendance at MSU Denver, and should familiarize themselves with the policies found in the [MSU Denver Catalog](#).

## WITHDRAWAL FROM A COURSE

Students should be aware that any kind of withdrawal can have a negative impact on some types of financial aid and scholarships. For further information, click on read the [Withdrawals](#) page.

The Withdrawal (W) notation is assigned when a student officially withdraws from a course via the Student Hub after the drop deadline (census date) and before the withdrawal deadline posted in the [2016-2017 Academic Calendar](#). Deadlines differ proportionally for courses offered during part of a semester, including late-start and weekend courses. Students should refer to the Student Detail Schedule via the Student Hub to review drop and withdrawal deadlines for individual courses. When a student withdraws from a course, no academic credit is awarded. The course remains on the student's academic record with a "W" notation and counts toward the student's attempted hours. The course is not calculated in the student's GPA or quality points. Students who withdraw from a course are responsible for the full tuition and fees for that course. After the withdrawal deadline, students may not withdraw from a course and will be assigned the grade earned based on the course syllabus. A student-initiated withdrawal will appear as an "F" on the student's academic record in any case of academic misconduct resulting in a permanent "F".

For more information see the [Withdrawal](#) page.

**For your drop/refund or Withdrawal dates logon to your STUDENT HUB account and look at your Student Detail Schedule.**

## ADMINISTRATIVE WITHDRAWAL

The Administrative Withdrawal (AW) notation is assigned when a student requests to be withdrawn from a course due to unforeseen or extenuating circumstances beyond the student's control.

Students may withdraw themselves online through the withdrawal deadline. Students should meet with an academic advisor prior to withdrawing from a course. After the withdrawal deadline, students may submit a request for AW due to unforeseen or extenuating circumstances.

For more information see [Administrative Withdrawal](#) page.

## INCOMPLETE POLICY

The Incomplete (I) notation may be assigned when a student who is achieving satisfactory progress in a course and who has completed most class assignments is unable to take the final examination and/or does not complete all class assignments due to unusual circumstances, such as hospitalization or disability. Incomplete work denoted by the Incomplete "I" notation must be completed within one calendar year or earlier, at the discretion of the faculty member. If the incomplete work is not completed within one year, the "I" notation will convert to an "F." Students must have completed at least 75% of the course work to qualify for consideration for an incomplete. The student must be passing the course in order to be granted an incomplete. The course counts toward the student's attempted hours, does not count toward earned hours, and is not calculated in the GPA or quality points.

Determination of eligibility does not guarantee that an incomplete will be granted. Students who meet the qualifications may request an incomplete from the faculty member who is teaching the course. The decision to grant an incomplete is up to the faculty member or at the department chair's discretion. The decision to grant an incomplete as an accommodation based on a student's disability shall be made by the faculty member or the department chair, if the faculty member is not available, in consultation with the Director of the Access Center.



If an incomplete is granted, the student and instructor should fill out and sign an Incomplete Agreement form to clarify what the student needs to do to complete the course.

For further information see the [Incomplete notation](#) page.

## BEST GRADE STANDS

A student's grades for repeated courses will be removed from GPA calculations up to 18 semester hours, regardless of the original grade earned. If a student repeats more than 18 credit hours, the student may designate which of the course grades are removed from GPA calculations (up to 18 semester hours). Only the best grade and its associated credit will be calculated in the GPA and earned hours totals. Other attempts for the course will appear on the official academic record but will be annotated to indicate they do not count for academic credit or GPA calculation. This policy applies only to courses taken at MSU Denver, and it does not apply to courses designated as repeatable toward degree requirements.

For more information see the [Best Grade Stands](#) page.

## ACADEMIC INTEGRITY

As students, faculty, staff and administrators of Metropolitan State University of Denver, it is our responsibility to uphold and maintain an academic environment that furthers scholarly inquiry, creative activity and the application of knowledge. We will not tolerate academic dishonesty. We will demonstrate honesty and integrity in all activities related to our learning and scholarship. We will not plagiarize, fabricate information or data, cheat on tests or exams, steal academic material, or submit work to more than one class without full disclosure.

For further information see the [Academic Integrity](#) and [Academic Dishonesty](#) page.

## PROHIBITION ON SEXUAL MISCONDUCT

Metropolitan State University of Denver prohibits sexual misconduct in any form, including sexual assault or sexual abuse, sexual harassment, and other forms of nonconsensual sexual conduct, including stalking and electronic harassment. Forms of intimate partner violence, including dating violence and domestic violence, are also prohibited under this policy. Students, faculty, staff and visitors, should be able to live, study, and work in an environment free from sexual misconduct. It is the policy of MSU Denver that sexual misconduct in any form will not be excused or tolerated. Retaliation in any form for reporting such sexual misconduct or for cooperating in a sexual misconduct investigation is strictly prohibited and will be addressed as a separate violation of the Student Code of Conduct. This policy is promulgated under Title IX of the Education Amendments of 1972 (Title IX), 20 U.S.C. §§ 1681 *et seq.*, and its implementing regulations, 34 C.F.R. Part 106; Title IV of the Civil Rights Act of 1964 (42 U.S.C. § 2000c).

For further information, see the [Title IX](#) page and refer to the [Student Code of Conduct](#) page.

## ACCOMMODATIONS TO ASSIST INDIVIDUALS WITH DISABILITIES

The Metropolitan State University of Denver is committed to making reasonable accommodations to assist individuals with disabilities in reaching their academic potential. If you have a disability which may impact your performance, attendance, or grades in this class and are requesting accommodations, then you must first register with the Access Center, located in the Plaza Building, Suite 122, 303-556-8387.

The Access Center is the designated department responsible for coordinating accommodations and services for students with disabilities. Accommodations will not be granted prior to my receipt of your faculty



notification letter from the Access Center. Please note that accommodations are never provided retroactively (i.e., prior to the receipt of your faculty notification letter.) Once I am in receipt of your official Access Center faculty accommodation letter, I would be happy to meet with you to discuss your accommodations. All discussions will remain confidential. Further information is available by visiting the [Access Center](#) website.

## CLASS ATTENDANCE ON RELIGIOUS HOLIDAYS

Students at MSU Denver who, because of their sincerely held religious beliefs, are unable to attend classes, take examinations, participate in graded activities or submit graded assignments on particular days shall without penalty be excused from such classes and be given a meaningful opportunity to make up such examinations and graded activities or assignments provided that advance written notice that the student will be absent for religious reasons is given to the faculty members during the first two weeks of the semester.

For further information, see the [Class Attendance](#) policies page.

## ELECTRONIC COMMUNICATION POLICY

Electronic communication (i.e., email and personal portal announcements) is a rapid, efficient and cost-effective form of communication. Consequently, reliance on electronic communication is expanding among students, faculty, staff and administration at MSU Denver. Because of this increasing reliance and acceptance of electronic communication, forms of electronic communication have become in fact the means of official communication to students, faculty and staff within MSU Denver. This policy acknowledges this fact and formally makes electronic communication an official means of communication for the University.

For more information, see the [Electronic Communication](#) policy page.

## FRESH START

Students returning from a period of absence from MSU Denver may request that credit and grades from designated semesters previously attempted at MSU Denver not be calculated in GPA's or total earned hours. If such a "Fresh Start" is approved, all courses from designated semesters will appear on the official academic record but will be annotated to indicate they do not count for academic credit or GPA calculation.

For more information, see the [Fresh Start](#) page.

***NOTE: If you have any difficulty accessing the hyperlinks in this document, please inform the instructor.***





## Essential General Knowledge Prerequisites!

It is assumed that you have acquired the following general knowledge skills in the sciences, language, and math through your education up to this point. It is the students FULL responsibility to make-up ANY deficiencies in these areas, preferably before enrolling in the course. I will NOT teach, lecture, or tutor any student in these basic High School skills and general knowledge subjects and no further instruction on the topics listed below will be given.

### Basic Office Software

You know how to properly use and command MS Word, MS Powerpoint, MS Excel. Graphing with Excel, putting figures / pictures into Word documents, compiling a short presentation using PowerPoint are expected skills in my course.

### English Language

Students should be able to write in short, clear, concise sentences when answering questions. Proper syntax becoming to a college student is expected. In many instances you will also be graded on professionalism which includes expressing yourself accordingly in writing. Unless otherwise instructed, always use third person when writing for the sciences. Usage of “I”, “we”, “my”, “mine”, “our”, is uncommon in technical writing and needs to be avoided.

### Basic Mathematical Operations

Students should be able to do the following mathematical operations without any further instructions:

- Round answer to significant digits
- Doing unit conversions (e.g.; continental drift happens at about 5.5cm/yr. How fast would this be in mph?)
- Percent calculations (e.g.; you measure 2.58g/cm<sup>3</sup>. The actual density is 2.65g/cm<sup>3</sup>. What is your percent error?)
- Using **units** in ALL your operations (*I am real stickler about that!*)
- Solving equations for an unknown value; manipulating equations (basic Algebra)
- Basic Geometry: surface areas, volumes, circumferences, areas, angles
- Scientific notations (e.g.; 1.8×10<sup>-9</sup>m/s) & scientific prefixes (milli-, mega-, terra-, micro-, etc.)
- Metric system & conversions within (µg, mg, g, kg, t, µm, mm, cm, m, km, m<sup>2</sup>, km<sup>2</sup>, cm<sup>3</sup>, m<sup>3</sup>, km<sup>3</sup>)
- Weights & Measurements (Both American and Metric)



Operating a scientific calculator (e.g.; know how to switch between degrees and radians, know how to use the arctangent function)  $\theta^\circ = \arctan(\text{rise/run})$  *Warning: NO cell phone calculators are allowed!*

### Graphing

You are required to be able to differentiate between bar, line and scatter graphs and know how and when each one needs to be constructed. Students should be able to hand-draw curved graphs without being sloppy. Be able to extrapolate values from any graph given, no matter the scale and type. You should also be very familiar with various types of graph paper and how to plot & read data with semi-log and log-log paper.

### Physics

Students should be familiar with basic Newtonian laws of motion and understand terms such as velocity, acceleration, inertia, mass vs. weight, force, gravitational constants, kinetic energy, potential energy. Being able to work with the following basic physics equations is a must (Middle School Physics!):

$$v=d/t \quad a=d/t^2 \quad a=(v_f-v_i)/t \quad F=ma \quad I=mv \quad KE=1/2mv^2 \quad PE=ma_g\Delta h \quad a_g=9.8m/s^2 \text{ or } 30ft/s^2$$

### Chemistry

Background in basic High School chemistry is essential. Students should know element names and associated symbols, how to read atomic weight and atomic mass from the periodic table, difference between covalent, ionic, metallic and hydrogen bonding, meaning of chemical formulas and subscripts. Students also need to understand pH and the difference between oxidizing and reducing environments. Furthermore, a working knowledge of solutions, solubility, mixtures, homogenous and heterogenous systems, and precipitation is a must.

### Geography

Students should know basic physical geography, which includes the location of countries, major mountain ranges, and major rivers.

### Drawing & Drafting

While the world is moving rapidly to electronic PC drafting, sketching results by hand is a essential skill in geology. Students must be able to use a drawing compass and a protractor. Sketching curves through data points neat and clean is another requisite skill.