Astronomy 121: The Solar System

Welcome!

Astronomy 121 is an introduction to planetary science, designed for non science majors. There is math but it is at the level of high school algebra and geometry.

If you just signed up for the course...

1. Buy an iclicker, register it on canvas and bring your iclicker for the first day of lecture. Clicker frequency is BB for this course.
2. Go to OpenStax and sign up to access their free astronomy text. Yes, it is free. All reading materials are free! We will be using a combination of the openStax text and other online reading materials located on canvas.
3. Please thoroughly read the syllabus (this page).
4. Enter all due dates into your calendar or app. Late homework is not accepted. In particular, memorize and write down these test days. You need to be here for at least one of the test days and for the final.

- Test 1: January 30th (Thursday)
- Test 2: February 27th (Thursday)
- Final: March 16 12:30 (Monday)

Quick and important policy information

- Course schedule is located under modules. All materials will be linked under modules (course notes, homework quizzes, etc).
- Participation is graded; You are graded on 12 out of 18 lecture attendances. See section on Iclickers, participation and In-class activities
• It is unnecessary to email me if you can't make a class. If you have trouble attending classes and you are working with the AEC or Dean's office, please read section on Iclickers, participation and In-class activities

• Be here for at least one of two tests (midterms). The final is mandatory. See section on Tests and Final

• Late homework assignments are not accepted and will receive zeros. See Homework. See Course Due Date Schedule below for all due dates

• However, if you need flexible deadlines AND you are working with the AEC or Office of the Dean of Students, read the section on AEC/Dean of Students under Homework.

• There is a curve for the class and it is based on the course average. Usually 75% is a B-.

**About this Course**

Have you ever wondered how we know what we know about the solar system and planets around other stars, aka exoplanets? Much of the information about other worlds comes from simple geometric tools and methods developed by those who lived at least 500 years ago. These techniques can determine the distances to nearby stars, planet-star distance and planet masses.

Advances in satellite and telescope technology have allowed us to peer even further in our own solar system and observe planetary surfaces, their composition and the processes that have shaped them, informing us about the evolution of Earth, the Solar system and life.

In this course, we will study these basic astronomy techniques by actively practicing them in class, demonstrating how we arrive at conclusions about other worlds. We will explore the multitude of new exoplanets discovered and the history of how astronomers pieced together a model of our Solar System.

**Why take this course?**
1) Everyone should have some understanding about our planet and origins on a cosmic scale!

2) Astronomy and similar science courses require you to reason, analyze and synthesize information in order to solve problems. Reasoning and critical thinking are always needed in the work world because not all problems can be solved by looking for answers on the internet. Think about it, nearly everyone has a phone and can look up information, but if you can apply some basic analysis to estimate an answer or arrive at a conclusion, you are ahead of the game. Plus, how do you know if a web source is reliable?

Your Instructor:

Dr. Elsa Johnson (Elsa)  elsa@uoregon.edu

Office: 143 Willamette Hall  Office Hours: 12-1pm Tuesdays and Thursdays

Note: the building where my office is located is different from the lecture hall building

At the end of the term you should be able to:

- Learn and use the tools developed by historic astronomers to determine planetary properties
- Determine the composition of a planet based on its size and mass
- Assess the internal workings of a planet based on surface features
- Apply the above techniques and findings of our own solar system and planet earth to conclude properties of other worlds.
- Understand the reason for the seasons
- Find the distance to nearby stars
- Appreciate where science facts and data come from that populate science websites.
- Know how planets are detected around other stars

Grade Weighting

- Best 7 out of 8 homework quizzes 28%
- PreLecture quizzes 10% (lowest 2 quizzes dropped)
- In-class participation/activities 10%
- Best of two tests: 19%
- Final 23%
- Project 10% 

**Course Due Date Schedule** (See Modules for topics detail and most accurate schedule)

<table>
<thead>
<tr>
<th>Week</th>
<th>Tuesday Lecture</th>
<th>Thursday Lecture</th>
<th>Homework</th>
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</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>1/7</td>
<td>1/9</td>
<td>Nothing due this week</td>
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<tr>
<td>Ancient Greece</td>
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<tr>
<td>Week 2</td>
<td>1/14</td>
<td>1/16</td>
<td>Homework 1 Due <strong>Friday 1/17 at 9pm</strong></td>
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<tr>
<td>Copernican Revolution/Brahe/Galileo Kepler, Newton and laws</td>
<td>Prelecture quiz 1/14 due at 4</td>
<td>Prelecture quiz 1/16 due at 4</td>
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<tr>
<td>Week 3</td>
<td>1/21</td>
<td>1/23</td>
<td>Homework 2 Due <strong>Wednesday 1/22</strong></td>
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<tr>
<td>Stellar coordinates, stellar motion, solar and sidereal day; properties of the Solar System, cratering.</td>
<td>Prelecture quiz 1/21 due at 4</td>
<td>Prelecture quiz 1/23 due at 4</td>
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<tr>
<td>Week 4</td>
<td>1/28</td>
<td>1/30</td>
<td>Homework 3 Due <strong>Wednesday 1/29</strong></td>
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<tr>
<td>Formation of the solar system, density and composition</td>
<td>Prelecture quiz 1/28 due at 4</td>
<td>TEST 1</td>
<td></td>
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<tr>
<td>Week 5</td>
<td>2/4</td>
<td>2/6</td>
<td>Homework 4 Due <strong>Saturday 2/8</strong></td>
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<tr>
<td>moon and Mercury</td>
<td>Prelecture quiz 2/4 due at 4</td>
<td>Prelecture quiz 2/6 due at 4</td>
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<tr>
<td>Week</td>
<td>Topic</td>
<td>Dates</td>
<td>Quizzes/Due Dates</td>
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<tr>
<td>Week 6</td>
<td>Terrestrial worlds: Venus and Mars Earth</td>
<td>2/11</td>
<td>Prelecture quiz 2/11 due at 4</td>
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<td></td>
<td></td>
<td>2/13</td>
<td>Prelecture quiz 2/13 due at 4</td>
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<tr>
<td>Week 7</td>
<td>asteroid belt, Gas giants, meteors comets</td>
<td>2/18</td>
<td>Prelecture quiz 2/18 due at 4</td>
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<tr>
<td></td>
<td>asteroids</td>
<td>2/20</td>
<td>Prelecture quiz 2/20 due at 4</td>
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<tr>
<td>Week 8</td>
<td>Mass extinction, exoplanets</td>
<td>2/25</td>
<td>Prelecture quiz 2/25 due at 4</td>
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<td>2/27</td>
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<tr>
<td>Week 9</td>
<td>Exoplanet detection methods, life evolution</td>
<td>3/3</td>
<td>Prelecture quiz 3/3 due at 4</td>
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<td></td>
<td>on Earth</td>
<td>3/5</td>
<td>Prelecture quiz 3/5 due at 4</td>
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<td>Week 10</td>
<td>Looking for life in Universe; drake equation</td>
<td>3/10</td>
<td>Prelecture quiz 3/10 due at 4</td>
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<td>3/12</td>
<td>Prelecture quiz 3/12 due at 4</td>
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<tr>
<td>Week 11</td>
<td></td>
<td>3/16</td>
<td>Final McKenzie rm 125 12:30</td>
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**Readings**

I have MANY webpages and resources for course material including the free online text, OpenStax astronomy. Most of the canvas web pages were written by Prof. Greg Bothun here at the University of Oregon. Some of the material will be repeated between OpenStax and the canvas page readings. This is intentional. The material can be dense and it is helpful to read some of these topics from at least one other source. The reading schedule is located with the course schedule located on Modules. Go here --> [Modules](#).

**Do I read before or after relevant lecture?** The reading schedule is designed to read after the relevant lecture. For example, 1/7 Reading means that you read it after the lecture on 1/7. Of course, if you want to read ahead you may do so. But you are not expected to read material before we have discussed it in class.

**Be sure to read the material!** I know it is easy to get behind or skip readings but you need to **read the material** to help you understand the
purpose of in class activities, flesh out what is discussed in class and to help you with homework.

Some external links are simulations. In many, if not all simulations you will need to enable flash on your browser. Enable it for the sites I give you and these sites alone. It is easy to do, just google the relevant instructions for your browser if flash isn't working. If you don't have flash, it will ask if you want to download and this file is dangerous. Don't download it! If you are having trouble figuring it out, ask a friend, classmate, google it, or use another computer. I don't know if these simulations will work on phones.

If a link isn't working or a page no longer exists, please email me and I will find a comparable working link.

**Lecture**

Lectures will consist of some slides and many activities to help you understand the material. I will use Iclickers to assess whether you understand the results of activities, guide discussion and to determine if you participated. All lecture notes are posted in Canvas. They will be linked in 'Modules' and located under 'Files' on the side menu. Lecture format will be powerpoints with questions interspersed.

**Legal:** You are not allowed to record my lectures with video or audio devices. If working with the AEC and this is a necessary thing for you, please tell me that you plan to do this. You cannot post the recordings online. Consider this a legal document in case I find an unauthorized recording of me.

**Iclickers, participation and In-class activities**

In order for you to better understand the material, you will do activities in class. Evidence shows that most learn from doing rather than listening to a lecture. Activities may be in the form of a question, situation, experiment, simulation or image displayed on the projector. You will be given time to think, draw, write out notes depending on the activity. I will quiz you individually using Iclickers. If most of the class doesn't respond correctly, I
will ask the question again and you will discuss it with someone sitting next to you. Then you will revote on the same question. The purpose of this exercise is to make you think logically through your response. When you have to explain something, you have a greater grasp of what you get and what you don't get.

**Grading:**

Credit is given for answering 75% of the clicker questions for each lecture whether they are right or wrong. You can miss up to 6 lectures (not including test days) and it will not hurt your participation grade. However it may indirectly hurt your homework and test grades if you are missing out on class discussions.

**What if I have a waiver or valid excuse to miss class?**

If you have already given me or will give me a waiver for missing specific lectures, I'm going to use the above policy and treat those days you have an activity as a "missed day". Therefore it isn't necessary to give me an absence/waiver form. Just take those days as miss days. This is a lot easier for me and a lot fairer for all of you. Missing more days than this isn't optimal simply because you lose touch with the course. But if you happen to find yourself missing more than half the lectures, I have the following 2nd policy:

If you have issues attending class on a regular basis, I can eliminate the iclicker portion of your grade and distribute those 10% points to homework, tests, etc. If you are a candidate for this, you must email me and provide the necessary forms as to why you can't attend regularly (if you haven't done so already).

But let me be clear, this isn't for people who don't want to attend lecture, it's for those who have physical obstacles or are going to be gone for a long period of time (if you are going to be gone for a long period of time, you should reconsider taking the course). The iclicker points are easy points and so eliminating them from your grade will put more weight on more challenging things like homework and tests. **So think carefully before you decide that you want this.** Your grade in canvas would not reflect your true grade accurately since I can't change the weighting for different individuals in canvas.
What if I don't have my iClicker yet?

I have a few loaner iClickers available. You can also borrow one from a friend provided the person you are borrowing it from isn't using it in any other class this term. If available, I'll bring extra iClickers from the physics department for the first week.

What if I forgot my iClicker for a lecture?

This is about personal responsibility. If you forgot your iClicker, it's fine BUT accept this as one of your "miss" days. If you have lost and can't afford a new clicker, eg. I will look into providing you with an iClicker, but this is for extreme circumstances. **I won't accept pieces of paper as proof of your participation** because the whole point of using iClickers is for me to see if you are getting the concepts, not to just give you credit for coming to class.

There are no make ups for in-class participation.

**Registering iClicker:** You need to register it by going to the **i>clicker left menu item**. If you have already used it in a prior class, it should already be registered. If you are borrowing it from someone, they need to unregister it. Therefore you and a friend can't share an iClicker during the same term, even if they are not taking this class.

**iClicker Frequency:** This is set to **BB** unless there is a lecture next door using the same frequency (this has happened!). The only way to change it is when I have the iClicker receiver plugged in. Hold down the power button for 2 seconds and the preset frequency flashes, prompting you to change it. The default is usually not **BB**, so be sure to change it each time you come to class if you use it in another class this term.

**What if I don't receive credit and I was in class?:**

Always check your grades to see if you received credit for that day. I post grades the same day, usually within an hour after class. If you have a 0 and you were in class using your iClicker then either...

  •
o **You haven't registered your iclicker** If you haven't registered it, do so now and email me your iclicker number so I can give you the points on any questions you answered.

o **You were using the wrong frequency (must be BB) or your batteries died.** I can't do anything for either reason unless I know you and can verify that you were there. Usually it takes me 1/2 a term before I can match faces to names so don't count on that.

o **You left early/arrived late and missed over 25% of the questions - self explanatory.**

o **You accidentally used someone else's iclicker.** This happens and it's fixable. Just email me their iclicker number and I'll give you credit the questions you answered.

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**Homework Quizzes**

**About:** Homework is given as an online canvas quiz using the quiz interface. Material is drawn from the readings, lecture material and activities in class. Since these are open-book quizzes, most of the questions will be more than just looking up stuff in the reading. You will have to apply your knowledge and think about it. Some homework may involve an online simulation. The questions are multiple choice and automatically graded.

**Late Policy and Due dates:** Late homework **is not** accepted. The reason is that I post the answers so you have the correct answers. The only exceptions are working through the AEC or dean of Students office (see below for alternative homework) and poor weather that knocks out power. In the case of city wide loss of power, I extend the due date. **Therefore: Please pay attention to these and turn your work in by the due dates. All assignments are due by 9pm.**

There is a generous gap of time between the topics discussed for homework and the homework due date. Homework due on Wednesdays covers material up through the Thursday from the week before. Homework due on Saturdays covers material up through the last Tuesday. The first homework is given an extended due date of Friday due to late enrollments. General topics or
readings will be listed on each quiz. Of course some quiz material may rely on information from previous homework topics.

**Grading:** You have 3 attempts for each homework quiz. Your grade will be the highest scored attempt. After each attempt, you can see which ones you got wrong and which you got correct. **Be sure to write down the answers you got correct and NOT JUST THE LETTERS! before you take the next attempt.** Canvas doesn't save them and the multiple choice answers are scrambled after each attempt.

**Dropping lowest score:** You will be graded on the best 7 out of 8 homework quizzes. Each is worth the same amount of points. Canvas automatically takes care of this so no need to tell me which quiz you wish dropped.

**AEC/Dean of Students:**

For those who do need flexibility in deadlines I will offer alternative written assignments. These consist of written answer, calculation and/or diagrams. They are completely different from the homework quizzes but cover the same material and worth the same in points. **This is only offered to individuals working with the Dean of Students or AEC and have explicitly requested and need flexible deadlines.**

If this sounds like you, you must email me and let me know that you intend to do these written assignments (you can still do the homework quizzes if you prefer but you are held to the same deadlines as everyone else). I will email the assignment(s) directly to you and you must get them back to me by Wednesday March 11th at midnight.

**Course Project**

You will complete one project due the Friday of the 9th week of classes (3/6). The project is simple, fun and your opportunity to actually "do" science. See this page Course Project or click on course project in the assignments section in the side menu.

**Pre-lecture Quizzes**
Prelecture quizzes on Canvas will gently test you on information from the prior lecture before attending next lecture. This way you are prepared for class and keeping up with the reading. These are collectively worth 10% of your grade. The first quiz is due Tuesday of the 2nd week. Late quizzes are allowed but will lose at least 25% if submitted within 24 hours past the deadline and at least 50% if submitted after this time. Late quizzes are accepted up to the time of the final 12:30 March 16th. **Like the homework, you will have 3 chances on each prelecture quiz.** Unlike the homework, these quizzes will test you on facts and information you can look up in the reading or notes, therefore they are easier than the homework.

**Tests and Final**

**About:** All tests will cover material discussed in lecture and in the homework. The tests will use scantron forms and be a blend of multiple choice, true/false, matching, fill in the blank and possibly short answer. **The final will be a similar format but longer and cumulative. I will hand out study guides.** These will be linked in the modules and found under 'Files'.

**Test materials:** Tentatively, all you need to bring to the tests and final is a pencil. I will provide scantron forms and hand out scratch paper if you need it. **These are all closed-book exams.**

**Tests:** You will be given 2 tests- one **during week 4 (1/30/20) and one during week 8 (2/27/20).** Your test grade is based on the highest grade of either test. You are only required to take one but I recommend taking both especially if you want the chance to improve your grade.

"Best of two" tests accommodates those who either get sick, have a personal crisis or can't make a test date for whatever reason. It minimizes the need to give make up exams, which is necessary in classes larger than 50 students. You can think of the 2nd test as a makeup test if you miss the first one. Unless you missed both tests due to an extreme reason or the university is making you do something, I will not offer one. **Make up exams are written answer (not multiple choice).**

**If you can't make either test due to foreseen conflicts then you need to reconsider taking the course.**
**Final: The final is cumulative.** I will hand out a study guide. It will be a longer version of the tests. You must be here for the exam unless you are working with the AEC.

**Final Test Date:** The test will be offered at the scheduled time (12:30 March 16th) in McKenzie 125. You can’t take it earlier or later (I prefer closest to scheduled time for AEC as well), so make your vacation/work plans accordingly. According to school policy, if you have **more than 3** (read 4) finals in one day you can reschedule the final but rescheduling goes in order of last exam scheduled for that day. Here is the exact phrasing of the policy from the registrar:

> Students who are scheduled for more than three examinations within one calendar day may take the additional examination later in the week. The instructor of record for the course beyond the third examination, counting in the order the examinations are scheduled, will arrange for a makeup examination.

If you are on the road due to UO duties (other than sports, no other department would do this) then you must coordinate with your advisor or person in charge of the activity to proctor the exam. Have them contact me for information.

Finally, if you decide not to show up to the final for whatever reason, your course grade will be calculated with a 0 for your final exam grade.

**Canvas Interface and Grades**

The way Canvas calculates the total grade can and has been totally misleading for those who are not familiar how weights and percentages work. For instance, if you have submitted a total of 3 out of 6 assignments it will base your grade on those three assignments not 6. So if you got 100% on all 3 assignments but didn't submit three of them then your grade will read 100% and not 50%. Sometimes I forget to enter a zero for non-submissions and people are surprised when their grade goes down when I eventually do enter zeros. Now you know.

**Math**
There is math in this course because it is needed to draw conclusions about planets but it limited to high school level algebra and geometry. You will have about 4 equations in this class which will go over quite a bit for the first 3-4 weeks. They are necessary to explain orbit distances, stellar distances and compositions of planets. We will be working on these in class, so do attend as many lectures as you can!

**Help**

Presently, help is limited to my office hours and emails. I'll send out emails and announcements if many are confused on the same topic. Please don't hesitate to ask me questions and come to office hours if you are struggling.

Before I forget, here are my general policies on cheating and copying.
Academic Dishonesty

- **Copying:** You are free to study and discuss the course work with others, but if you and your study partner have identical essay answers or even just switch a few words or sentences around in any graded work, this is considered copying and each results in zero credit for all similar answers. Even in a class this size, it is easy to catch so don't do it! I am brutal about this. You won't have essays on homework quizzes, however your projects must be unique work and you must use your own words.

- **Cheating:** If you are caught cheating looking at your neighbor’s test or with notes either on your phone, any electronic device, a piece of paper, hat, arm, water bottle or whatever, you get an automatic 0 on the test. Therefore, no headphones, sunglasses, or phones during test time. If I suspect you looking at your neighbor's test, I will ask you to move. *Just so you know, it's incredibly obvious when someone is looking at another person's test because they tend to move their head a lot and keep looking at the instructor to make sure they aren't caught. This is really easy to spot when everyone else is else is focusing on their test.*

- **Avoiding Plagiarism:** Again, this will mainly apply to your course project. Don't cut and paste text from sources to answer questions where relevant - even if you use quotes and cite sources. Quotes are never used in science papers unless it's a book about a scientist. If you cut and paste text, change a few words and don't cite sources this is considered plagiarism and very very bad! Some professors make it a mission to go after students by notifying administrators and professors of the suspected plagiarist.

In case you are asked to look up information on other websites: You are to respond to these questions by writing the answer in your own words. **Do cite sources (a link to the website is just fine), but don't use quotes from the articles to answer the question.**

Campus resources to support your learning

**Tutoring and Learning Center (TLC)** Drop-in math and writing support in addition to tutoring, study skills support, and Class Encore. Located in the 4th Floor Knight Library (541) 346-3226, tlc@uoregon.edu

**Counseling Center** Call anytime to speak with a therapist who can provide support and connect you with resources. Located on the 2nd Floor of the Health Center (541)346-3227

**Accessible Education Center** The University of Oregon is working to create inclusive learning environments. If there are aspects of the instruction
or design of this course that result in barriers to your participation, please let me know as soon as possible. I encourage you to contact the Accessible Education Center. If you are not a student with a documented disability, but you would like for us to know about class issues that will impact your ability to learn, we encourage you to come visit during office hours so that we can strategize how you can get the most out of this course. Located on the 1st Floor of Oregon Hall (541) 346-1155, uoaec@uoregon.edu

Note: If you need to record lectures, you must ask me first and you cannot post my recorded lectures on the web where they would be publicly accessible.

Center for Multicultural Academic Excellence (CMAE) mission is to promote student retention and persistence for historically underrepresented and underserved populations. They develop and implement programs and services that support retention, academic excellence, and success at the UO and beyond. They reaffirm our commitment to all students, including undocumented and tuition equity students. Located on the 1st Floor of Oregon Hall (541) 346-3479, cmae@uoregon.edu

Inclusiveness

Open inquiry, freedom of expression, and respect for difference are fundamental to a comprehensive and dynamic education. We are committed to upholding these ideals by encouraging the exploration, engagement, and expression of divergent perspectives and diverse identities.

Our Duty to Report
The graduate assistants and I are Student-Directed Employees. As such, if you disclose sensitive information to us, we will respond to you with respect and kindness. We will listen to you and will be sensitive to your needs and desires. We will not judge you. We will support you. We will direct students who disclose sexual harassment or sexual violence to resources that can help and will only report the information shared to the university administration when the student requests that the information be reported. As Student-Directed Employees, we can offer privacy because we are not required to report certain information to the university. However, we cannot be bound by confidentiality in the same way that a counselor or attorney is. Unless someone is in imminent risk of serious harm or is a minor, we will keep your disclosure private. Please note the
differences between confidential and private. For more information on reporting obligations of employees and specific details about confidentiality of information, visit titleix.uoregon.edu

**Discrimination and Harassment Resources**

Additional help and resources for any student who has experienced sexual assault, relationship violence, sex or gender-based bullying, stalking, and/or sexual harassment are available at safe.uoregon.edu or by calling the UO’s 24-hour hotline 541-346-7244 [SAFE] or the non-confidential Title IX Coordinator at 541-346-8136.

Students experiencing any other form of prohibited discrimination or harassment can find information at respect.uoregon.edu or aaeo.uoregon.edu or contact the non-confidential AAEO office at 541-346-3123 or the Dean of Students Office at 541-346-3216.

**Final Note from yours truly:**

If you are struggling in this or any class, remember this: The real way to learn something new is to accept that struggle and failure are an essential part of the learning process. Seriously. I can't tell you how many times I have failed initially when solving new problems. It's rare that I or anyone else gets it right on the first try. But I must keep at it until I get the job done because no one else can do it for me. In some situations I have to find a solution because others are relying on me and I won't get paid. That's how real life works. Our society, particularly social media, focuses too much on the end product of awesome skills and forgets there was a struggle to get there. So don't give up or panic if you do bad on something. Just stick with it and see me for help until it makes sense.

By the way, do not tell yourself or me that you do not have a scientific or mathematical mind. That is BS. If anyone told you this, even if it's someone who cares about you, they are wrong. There might be people who get concepts faster than you but there is evidence that slow learners have a greater depth of understanding when they finally figure out a subject. In my unofficial study, it's simply a matter of wanting to learn it or not. This means putting time into figuring it out. Truth be told, all fields -scientific or not -
require lots of practice and some amount of critical thinking. Otherwise we would all be skilled artists, poets, athletes etc.

I really want you to get something positive from the course - whether it's one topic that totally captures your imagination or just a general appreciation and new perspective of our place in the Universe. Let's make this a great term!