Syllabus for Astronomy 10

Course Information

Semester & Year: Spring 2023

Course ID & Section #: Astro 10 (D5035)

Instructor's name: Dr. Jon Pedicino

Day/Time/Location: Saturday, 5:00- 8:10 PM (A-YARD)

Course units: 3.0

Instructor Contact Information

(Via Mail)

Catalog Description

An overview of historical approaches to understanding the science of astronomy and our place in the universe. We will explore light and its role in the transmission of information, telescopes, the formation of the solar system, the planets and moons and their potential for life, the sun, the evolutionary life cycle and death of stars, black holes, and the formation of the universe.

Course Student Learning Outcomes *(from course outline of record)*

1. **Demonstrate how the scientific method is used to understand natural phenomena**
2. **Define and identify the different types of electromagnetic radiation.**
3. **Analyze the evolution of the solar system and the development of the Earth's atmosphere and landforms.**
4. **Define the nuclear processes that take place in the sun and relate those to the birth, evolution, and eventual death of the range of stars present in the cosmos.**

Grading

80%- Unit Summaries (12), 3 sides, Due Sat, 100 pts each, **20%**-Current Events (6), 1 side, Due S, 50 pts

A (>93.3%), A- (90-93.3%), B+ (86.7-89.9%), B (83.3-86.6%), B- (80-83.2%), C+ (76.7-79.9%), C (70-76.6%), D (55-69.9%), F (<55%)

Accessibility

Students will have access to course materials that comply with the Americans with Disabilities Act of 1990 (ADA), Section508 of the Rehabilitation Act of 1973, and College of the Redwoods policies. Students who discover access issues with this class should contact the instructor.

College of the Redwoods is also committed to making reasonable accommodations for qualified students with disabilities. If you have a disability or believe you might benefit from disability-related services and accommodations, please contact your instructor or Disability Services and Programs for Students (DSPS).

Astronomy 10 Class Schedule

Saturday, January 14- Book, Current Event Articles, Assignments, First Class

Saturday, January 21- First summary due

Saturday, March 11, March 18- **No classes those Saturdays**

Saturday, April 29- Last summary, Last current event due, **Last class**.

Astronomy 10 Topics/Outline

Textbook: Openstax Astronomy Book by Franknoi

**Current event due along with summary (you choose from Current Event Article Packet)

Due Date (Sat)	Unit#	Topic	Openstax Chapter
	1	Search for Life	
January 21	1	Requirements for Life	30.1-30.4
	2	Scientific Method	1.2
	2	Mass, Distance, Temp	1.4, Appendix C&D
January 28**	2	Light-year, Calendar	4.4, 1.4, 1.6, 1.5
	3	Night Sky, RA/Dec	2.1, 4.1
	3	Seasons	4.2
February 4	3	Moon Phases, Eclipses	4.5, 4.7
	4	Geocentrism vs. Heliocentrism	2.2, 2.4
	4	Galileo	2.4
February 11**	4	Kepler and Newton	3.1, 3.3, 3.4
	5	Nature of Light, EM Spectrum	5.1, 5.2
	5	Telescopes	6.1, 6.2
	5	Temp/Color, Spectroscopy	5.2, 5.3
February 18	5	Doppler Effect	5.6
	6	Big Bang, Galaxies	29.6, 29.3, 29.1-2
	6	Solar System Formation	7.4, 21.1, 21.3, 14.3
March 4**	6	Asteroids and Density	8.5, 7.1
	7	Earth,	8.1-8.4
March 25	7	Moon	9.1-9.4
April 1**	8	Terrestrial Planets	9.5, 10.1-10.6

April 8	9	Jovian Planets	11.1-3, 12.1-3, 12.5
April 15**	10	The Sun and Thermonuclear Fusion	15.1-15.4, 16.2-16.4
	11	Distance and Luminosity of Stars	19.2, 17.1
April 22	11	H-R Diagram, Mass, Spectral Class.	18.2, 18.3, 17.3, 18.4
	12	Stars, the Beginning of the End	21.2, 22.1, 22.4
	12	White Dwarfs and Planetary Nebulae	22.4, 23.1
April 29**	12	Supernovae and Black Holes	23.2-4, 24.5, 24.6

Summary Overviews

Astronomy 10, Summary 1 (Due Saturday, January 21)

Each summary should be a minimum of three sides (hand-written, front and back of a single sheet counts as 2 sides). The summary should address the topics you learned about from your reading in the textbook as assigned below. I have also included question prompts to give you a sense of the major themes you may choose to write about. You may choose to answer all or some of these questions in your summary. You may choose to highlight one particular topic that you found interesting. In this way, you can decide what themes you want to learn the most about.

Reading assignment for Unit 1

Topics	Book Chapter Assignment
Search for Life	
Requirements for Life	30.1-30.4

Questions to help you develop your Unit summaries

Unit 1: Search for Life

- Describe the chemical and environmental conditions that make Earth hospitable to life
- Describe the chemical building blocks required for life
- Describe some of the extreme conditions on Earth, and explain how certain organisms have adapted to these conditions
- Identify where in the solar system life is most likely sustainable and why
- Explain the use of biomarkers in the search for evidence of life beyond our solar system
- List efforts by humankind to communicate with other civilizations via messages on spacecraft
- Understand the various SETI programs scientists are undertaking

Astronomy 10, Summary 2 (Due Saturday, January 28)

-In addition, this week, please choose a **current event article** from the packet of articles you received at the beginning of the term. Read it and summarize what you learned in a one sided hand written write-up. Include this along with your summary and your weekly question in the material you hand in this week. Thanks!

Reading assignment for Unit 2

Topics	Book Chapter Assignment
Scientific Method	1.2
Mass, Distance, Temp	1.4, Appendix C&D
Light-year, Calendar	4.4, 1.4, 1.6, 1.5

Note: The Scientific Method starts by identifying a question or a problem. Then we gather data, do experiments, and observe. Next we come up with a theory or model to explain the observed data. Lastly, and most importantly, we test and retest that model with more experiments and data and make changes to it as needed. Everything we learn this term and in science in general is a work in progress and our best interpretation of the data that we have. Science is constantly striving for a better understanding…..the process is never complete.

Questions to help you develop your Unit summaries

Unit 2: Scientific Method/ Units of Mass, Distance, Temperature

- Describe the major steps of the scientific method and highlight the most important one
- Identify the major difference between Kelvin and Celsius/Fahrenheit
- Explain the significance of Absolute Zero and what it represents
- List the major units of distance used in Astronomy and what scale (e.g. on a planet, between planets, between stars) they might be useful for measuring the distance to.

Unit 2: Light year

- Understand how calendars varied among different cultures
- Explain the origins of our modern calendar
- Explain how the speed of light allows us to see back in time

Astronomy 10, Summary 3 (Due Saturday, February 4)

Reading assignment for Unit 3

Topics	Book Chapter Assignment
Night Sky, RA/Dec	2.1, 4.1
Seasons	4.2
Moon Phases, Eclipses	4.5, 4.7

Questions to help you develop your Unit summaries

Unit 3: Night Sky

- Define the main features of the celestial sphere
- Describe how motions of the Sun, Moon, and planets appear to us on Earth

- Understand the modern meaning of the term *constellation*
- Describe how latitude and longitude are used to map Earth
- Explain how right ascension and declination are used to map the sky

Unit 3: Seasons and Moon Phases

- Describe how the tilt of Earth's axis causes the seasons
- Explain how seasonal differences on Earth vary with latitude
- Explain the cause of the lunar phases
- Understand how the Moon rotates and revolves around Earth
- Describe what causes lunar and solar eclipses
- Explain why lunar eclipses are much more common than solar eclipses

Astronomy 10, Summary 4 (Due Saturday, February 11)

In addition, this week, please choose a **current event article** from the packet of articles you received at the beginning of the term. Read it and summarize what you learned in a one sided hand written write-up. Include this along with your summary and your weekly question in the material you hand in this week. Thanks!

Reading assignment for Unit 4

Topics	Book Chapter Assignment
Geocentrism vs. Heliocentrism	2.2, 2.4
Galileo	2.4
Kepler and Newton	3.1, 3.3, 3.4

Questions to help you develop your Unit summaries

Unit 4: Our Place in the Universe: Geocentrism to Heliocentrism, Ptolemy to Galileo, Kepler and Newton

- Describe Ptolemy's geocentric system of planetary motion
- Explain the Copernican model of planetary motion and describe evidence or arguments in favor of it
- Explain how Galileo's discoveries tilted the balance of evidence in favor of the Copernican model
- Explain Kepler's three laws of planetary motion
- Explain what determines the strength of gravity
- Explain the difference between mass and weight

Astronomy 10, Summary 5 (Due Saturday, February 18)

Reading assignment for Unit 5

Topics	Book Chapter Assignment
Nature of Light,EM Spectrum	5.1, 5.2
Telescopes	6.1, 6.2

Temp/Color, Spectroscopy	5.2, 5.3
Doppler Effect	5.6

Questions to help you develop your Unit summaries

Unit 5: Light and the Electromagnetic Spectrum, Spectroscopy, Temperature and Color, Doppler Effect

- Describe the relationship between wavelength, frequency, and speed of light
- Discuss the particle model of light and the definition of photon
- Explain how and why the light emitted by an object depends on its temperature
- Explain how astronomers learn the composition of a gas by examining its spectral lines
- Discuss the various types of spectra
- Describe how we can use the Doppler effect to deduce how fast astronomical objects are moving through space

Unit 5: Telescopes

- Describe the main functions of a telescope
- Describe the two basic types of visible-light telescopes and how they form images
- Discuss the factors relevant to choosing an appropriate telescope site
- Define the technique of adaptive optics and describe the effects of the atmosphere on astronomical observations

Astronomy 10, Summary 6 (Due Saturday, March 4)

In addition, this week, please choose a **current event article** from the packet of articles you received at the beginning of the term. Read it and summarize what you learned in a one sided hand written write-up. Include this along with your summary and your weekly question in the material you hand in this week. Thanks!

Reading assignment for Unit 6

Topics	Book Chapter Assignment
Big Bang, Galaxies	29.6, 29.3, 29.1-2
Solar System Formation	7.4, 21.1, 21.3, 14.3
Asteroids and Density	8.5, 7.1

Questions to help you develop your Unit summaries

Unit 6: The Big Bang, Galaxies, and the Formation of the Solar System

- Name the four forces that control all physical processes in the universe
- Describe what the universe was like during the first few minutes after it began to expand
- Explain how the first new elements were formed during the first few minutes after the Big Bang
- Describe how we estimate the age of the universe

- Describe the evidence that dark energy exists and that the rate of expansion is currently accelerating
- Explain the importance of collisions in the formation of the solar system
- Summarize the physical and chemical changes during the solar nebula stage of solar system formation
- Explain the formation process of the terrestrial and giant planets

Unit 6: Impacts, Density as a Tool

- Explain the scarcity of impact craters on Earth compared with other planets and moons
- Describe the evidence for recent impacts on Earth
- Detail how a massive impact changed the conditions for life on Earth, leading to the extinction of the dinosaurs
- Discuss the search for objects that could potentially collide with our planet
- Model the solar system with distances from everyday life to better comprehend distances in space
- Describe how average density of a planet is a useful tool to uncover internal composition

Astronomy 10, Summary 7 (Due Saturday, March 25)

Reading assignment for Unit 7

Topics	Book Chapter Assignment
Earth	8.1-8.4
Moon	9.1-9.4

Questions to help you develop your Unit summaries

Unit 7: Earth

- Describe the components of Earth's interior and explain how scientists determined its structure
- Specify the origin, and extent of Earth's magnetic field
- Explain the theory of plate tectonics
- Describe the difference between rift and subduction zones
- Differentiate between Earth's various atmospheric layers
- Describe the chemical composition and possible origins of our atmosphere
- Explain the ways that life and geological activity have influenced the evolution of the atmosphere
- Describe the causes and effects of the atmospheric greenhouse effect and climate change

Unit 7: Moon

- Differentiate between the major surface features of the Moon
- Describe the properties of the lunar "soil"
- Explain the process of impact crater formation
- Discuss the use of crater counts to determine relative ages of lunar landforms
- Describe the top three early hypotheses of the formation of the Moon
- Summarize the current "giant impact" concept of how the Moon formed

Astronomy 10, Summary 8 (Due Saturday, April 1)

In addition, this week, please choose a **current event article** from the packet of articles you received at the beginning of the term. Read it and summarize what you learned in a one sided hand written write-up. Include this along with your summary and your weekly question in the material you hand in this week. Thanks!

Reading assignment for Unit 8

Topics	Book Chapter Assignment
Terrestrial Planets	9.5, 10.1-10.6

Questions to help you develop your Unit summaries

Unit 8: Terrestrial Planets

- Explain the relationship between Mercury's orbit(revolution) and rotation
- Describe the topography and features of Mercury's surface
- Explain why it's difficult to learn about Venus from Earth-based observation alone
- Compare the basic physical properties of Earth, Mars, and Venus
- Describe the general features of the surface of Venus
- Explain why the surface of Venus is inhospitable to human life
- Explain how the greenhouse effect has led to high temperatures on Venus
- Discuss the main missions that have explored Mars
- Describe the general conditions and features on the surface of Mars
- Describe the general composition of the atmosphere on Mars
- Describe the evidence for the presence of water in the past history of Mars
- Summarize the evidence for and against the possibility of life on Mars
- Compare the planetary evolution of Venus, Earth, and Mars

Astronomy 10, Summary 9 (Due Saturday, April 8)

Reading assignment for Unit 9

Topics	Book Chapter Assignment
Jovian Planets	11.1-3, 12.1-3, 12.5

Questions to help you develop your Unit summaries

Unit 9: Jovian Planets

- Chronicle the robotic exploration of the outer solar system
- Describe the basic physical characteristics, general appearance, atmospheric composition, and rotation of the giant planets
- Describe the discovery and characteristics of the giant planets' magnetic fields
- Understand the scale and longevity of storms on the giant planets
- Name the major moons of each of the Jovian planets
- Explain what may be responsible for the unusual features on the icy surface of Europa

- Explain how tidal forces generate the geological activity we see on Europa and Io
- Explain how the thick atmosphere of Titan makes bodies of liquid on its surface possible
- Describe what we learned from the landing on Titan with the Huygens probe
- Discuss the features we observed on the surface of Triton when Voyager 2 flew by
- Describe the two theories of planetary ring formation

Astronomy 10, Summary 10 (Due Saturday, April 15)

In addition, this week, please choose a **current event article** from the packet of articles you received at the beginning of the term. Read it and summarize what you learned in a one sided hand written write-up. Include this along with your summary and your weekly question in the material you hand in this week. Thanks!

Reading assignment for Unit 10

Topics	Book Chapter Assignment
The Sun and Thermonuclear Fusion	15.1-15.4, 16.2-16.4

Questions to help you develop your Unit summaries

Unit 10: The Sun and the Physics of its Interior

- Explain how the composition of the Sun differs from that of Earth
- Explain the different parts of the Sun's atmosphere
- Describe the sunspot cycle
- Explain how magnetism is the source of solar activity
- Describe the various ways in which the solar activity cycle manifests itself, including flares, coronal mass ejections, prominences, and plages
- Explain how matter can be converted into energy
- Trace the nuclear reactions in the solar interior
- Describe the state of equilibrium of the Sun
- Explain how energy moves outward through the Sun
- Discuss how studying neutrinos from the Sun has helped understand it's core

Astronomy 10, Summary 11 (Due Saturday, April 22)

Reading assignment for Unit 11

Topics	Book Chapter Assignment
Distance and Luminosity of Stars	19.2, 17.1
H-R Diagram, Mass, Spectral Class.	18.2, 18.3, 17.3, 18.4

Questions to help you develop your Unit summaries

Unit 11: Understanding Stars: Distance, Luminosity, Mass, and Spectral Classification, H-R Diagram

- Understand the concept of triangulating distances to distant objects, including stars

- Explain why space-based satellites deliver more precise distances than ground-based methods
- Explain the difference between luminosity and apparent brightness
- Understand how astronomers specify brightness with magnitudes
- Distinguish the different types of binary star systems
- Understand how we can apply Newton's version of Kepler's third law to derive the sum of star masses in a binary star system
- Describe how astronomers use spectral classes to characterize stars
- Discuss the physical properties of most stars found at different locations on the H–R diagram, such as radius, and for main sequence stars, mass

Astronomy 10, Summary 12 (Due Saturday, April 29), Last date to turn in past summaries)

In addition, this week, please choose a **current event article** from the packet of articles you received at the beginning of the term. Read it and summarize what you learned in a one sided hand written write-up. Include this along with your summary and your weekly question in the material you hand in this week. Thanks!

Reading assignment for Unit 12

Topics	Book Chapter Assignment
Stars, the Beginning of the End	21.2, 22.1, 22.4
White Dwarfs and Planetary Nebulae	22.4, 23.1
Supernovae and Black Holes	23.2-4, 24.5, 24.6

Questions to help you develop your Unit summaries

Unit 12: Stars, Running out of Gas and Dying: White Dwarfs to Neutron Stars, Pulsars, and Black Holes

- Describe what happens to the cores and surfaces of main-sequence stars of various masses as they exhaust their hydrogen supply
- Define "planetary nebulae" and discuss their origin
- Discuss the creation of new chemical elements during the late stages of stellar evolution
- Distinguish which stars will become white dwarfs
- Describe the interior of a massive star before a supernova
- Explain the steps of a core collapse and explosion
- List the hazards associated with nearby supernovae
- Describe the features of a neutron star that allow it to be detected as a pulsar
- Explain the event horizon surrounding a black hole
- Discuss why the popular notion of black holes as great sucking monsters that can ingest material at great distances from them is erroneous
- Use the concept of warped spacetime near a black hole to track what happens to any object that might fall into a black hole
- Describe what to look for when seeking and confirming the presence of a stellar black hole
- Explain how a black hole is inherently black yet can be associated with luminous matter
- Differentiate between stellar black holes and the black holes in the centers of galaxies