Astronomy 1A: Introduction Course Syllabus

What you will learn in this course

Astronomy 1A: Introduction

Follow your enthusiasm for space by introducing yourself to the study of astronomy. This course will include topics such as astronomy's history and development, basic scientific laws of motion and gravity, the concepts of modern astronomy, and the methods used by astronomers to learn more about the universe. Further knowledge is gained through the study of galaxies, stars, and the origin of the universe.

Unit 1: The Universe

We will take a journey through space and time from the beginning to the end of the universe. Can you think of anything larger or more expansive than the universe? How was the universe created? How is the universe changing? What exactly is our universe made from? These are all questions that scientists have been trying to answer since the idea of a universe was formed in the minds of our earliest cosmologists. Astronomers and other scientists have since accumulated a great deal of knowledge about what has happened—and what is currently happening—since the inception of the universe.

What will you learn in this unit?

- Describe the study of the cosmos.
- Discuss the theory of the origin of the universe.
- Analyze the evidence that supports the Big Bang theory.
- Examine the composition of matter and how it is distributed within the universe.
- Describe the theories of evolution and fate of the universe.

Unit 2: Techniques and Tools of the Trade: Studying the Universe

At one point or another, you have probably looked up at the sky at night and thought about how big the universe really is. At times, space can appear like an empty vacuum, and other times, we realize that the universe is filled with such a wide variety of materials, substances, and celestial bodies that it seems more than overwhelming. Scientists have been studying the universe for thousands of years in various ways using many different processes and tools. Today, astronomers follow the scientific method and utilize several types of astronomical tools including binoculars, telescopes, and even software that can replicate the night sky! How will you apply these techniques and tools to study our universe?

What will you learn in this unit?

- Distinguish science from pseudoscience
- Discuss the impact of scientific research on our society
- Follow the steps of the scientific method to conduct an astronomy investigation
- Choose proper tools and follow safety procedures in the field

Unit 3: The Earth, Moon, and Sun Systems

Day turns into night, and summer turns into fall. Why do we experience these predictable changes on Earth? In this unit, we will explore the systems and interactions between the sun, Earth, and moon. You will learn how the Earth's motion in space causes us to experience days, nights, and seasons in a cyclic pattern. We will discuss the properties of gravity and how gravity affects the relationships between orbiting bodies in space. You will discover how solar and lunar eclipses occur and examine the characteristics, origin, and phases of the moon.

What will you learn in this unit?

- Learn about the movements of celestial bodies in the sky.
- Describe how the motion of the Earth causes seasons and night-day cycles.
- Identify the characteristics and phases of the moon.
- Explore how the moon's gravitational pull manipulates tides on Earth.
- Distinguish between a lunar eclipse and a solar eclipse.

Unit 4: Stars

What are stars? Where did they come from? Will stars evolve with time? In this unit you will discover the secrets behind the stars in our night sky. We will solve the mystery behind why and how stars shine. We will explore the characteristics and composition of stars. You will learn how astronomers classify types of stars using the H-R diagram and how stars are identified within the celestial sphere. Finally, we will examine the evolution, or life cycle, of a star from conception to death.

What will you learn in this unit?

- Describe the composition and characteristics of stars.
- Learn how astronomers identify and describe constellations such as Ursa Major, Ursa Minor, Orion, and Cassiopeia.
- Analyze and characterize stars by their physical and chemical properties.
- Explain the use of diagrams and models in obtaining physical data on stars.
- Examine the evolution of stars.

Astronomy 1A Midterm Exam

- Review information acquired and mastered from this course up to this point.
- Take a course exam based on material from the first four units in this course (Note: You will be able to open this exam only one time.)

Unit 5: Galaxies

Galaxies are beautiful, majestic, and mysterious places within our universe. Our home in the Milky Way galaxy is a galactic suburb, far from other galaxies. Our Sun is just one of approximately 500 billion stars in our galaxy, meaning that there could possibly be up to 500 billion solar systems, maybe like our own, in the universe. In addition, the Milky Way galaxy is only one of the 50 billion to one trillion galaxies that are thought to exist in our observable universe. Compared with the whole universe, our home, Earth, is like a speck of sand in the largest desert imaginable.

In this unit, we will examine and describe the evolution, organization, distribution, and differences among types of galaxies. You will be able to characterize the movement of galaxies within the universe and describe the properties of our own galaxy, the Milky Way. Finally, we will discover the incredibly mysterious and dark forces that shift and shape galaxies.

What will you learn in this unit?

- Differentiate and describe the types of galaxies within the universe.
- Characterize the Milky Way.
- Identify how galaxies are organized and distributed within the universe.
- Describe the evolution of galaxies.
- Examine the forces that shape galaxies of stars.

Unit 6: The Milky Way

You have just traveled through the universe, exploring the different galaxies that make up outer space. Now, it's time to return to our own galaxy: the Milky Way. The Milky Way galaxy is what houses the solar system within which our planet Earth resides. Just how old is the Milky Way? And what kind of tools do scientists use to understand our galaxy? It's time to drive a little deeper into our home galaxy of the Milky Way.

What will you learn in this unit?

- Find ways to determine the age of the Milky Way
- Discover the oldest planet located in the Milky Way
- Decipher why there are more younger stars than older stars in the galaxy
- Understand Gaia Mapping and how it is used today

Unit 7: Black Holes

Possibly no celestial object has captured the attention and imagination of scientists and lay people the way black holes have. Even before they were officially "discovered," people noticed areas of darkness in the night sky. Now that we know more about black holes, it seems the questions just keep coming. Their power and force are only beginning to be understood by scientists.

What will you learn in this unit?

- Define black holes and understand why they are important
- Trace the history of black holes
- Answer questions about how we detect black holes, how they form, and how big and strong they are
- Discuss what happens at the event horizon and singularity of a black hole
- Investigate time travel options that black holes might offer

Unit 8: Becoming a Space Professional

Now that we've discussed what the universe is, how it is studied, and where we fit in, you may be eager to explore ways that you can continue learning even more about space! In this unit we'll explore careers in astronomy from astronauts who literally travel through the stars to the crew that supports them on the ground—and much more. Whether you have more technical and mathematical skills, love writing and communication, or want to "stay in school" forever, there is likely a career for you in the aerospace industry.

What will you learn in this unit?

- Understand what skills are required to enter into various space-related careers
- Discuss the roles in the mission control center that support astronauts in space
- Investigate other careers that support space missions and exploration
- Create an education plan that will prepare you for a career in astronomy

Astronomy 1A Final Exam

- Review information acquired and mastered from this course up to this point.
- Take a course exam based on material from units five to eight in this course – the last four units. (Note: You will be able to open this exam only one time.)

Astronomy 1B: Exploring the Universe Course Syllabus

What you will learn in this course

Astronomy 1B: Exploring the Universe

Building upon the prior prerequisite course, dive deeper into the universe and develop a lifelong passion for space exploration and investigation. Become familiar with the inner and outer planets of the solar system as well as the sun, comets, asteroids, and meteors. Additional topics include space travel and settlements as well as the formation of planets.

Unit 1: Space Explorers

Ancient civilizations the world over all developed methods of observing and tracking the heavens above. Some of these techniques the cultures shared in common, and some are unique to different parts of the world. But they all form the fabric of the history of astronomy and paved the way for some of the most technologically advanced scientific feats known to mankind: space missions! In this unit, we will travel from ancient China to ancient Egypt, Europe, and the Americas tracing the astronomical contributions of various civilizations before we arrive to consider our own civilization—and some of the most significant space missions to date.

What will you learn in this unit?

- Discover how ancient Chinese and Egyptian cultures integrated astronomy into their everyday lives.
- Understand how ancient Europeans and Native Americans built their civilizations around the movement of celestial objects.
- Trace the history of the space race between the United States and the Soviet Union.
- Discuss how and why noteworthy American space missions made history.

Unit 2: Inner Planets

The inner planets of our solar system are more closely related than the outer planets of the solar system. These planets are sometimes referred to as terrestrial planets and include Mercury, Venus, Earth, and Mars. Although all of these planets are notably rocky and dense, each one is unique. In this unit, we will examine the formation of our solar system, describe the unique features of the four inner planets, Mercury, Venus, Earth, and Mars, and compare and contrast their characteristics. Finally, you will discover the special attributes that make life on Earth possible.

What will you learn in this unit?

- Describe how planetary matter is distributed within the solar system.
- Explain the formation of the solar system.
- Differentiate and describe the inner planets within our solar system.

- Identify the shared characteristics among all inner planets in the solar system.
- Explain the features of Earth that are essential to the development of life.

Unit 3: Outer Planets

In this unit, we will examine the first two of our outer planets: Jupiter and Saturn. We'll learn more about their structure, motion, atmosphere, and moons. We'll examine what space expeditions, observations, and mathematical predictions are telling us about these planets and their roles in our solar system.

What will you learn in this unit?

- Identify the shared features and characteristics among the outer planets in the solar system.
- Differentiate and describe the unique characteristics of Jupiter and Saturn.
- Understand how weight and mass measurements differ from Earth to Jupiter and Saturn.
- Compare and contrast the outer planets with Earth.

Unit 4: Outer Planets: Uranus, Neptune, and the Dwarf Planets

It's time to journey to the last two outer planets: Uranus and Neptune, and learn more about the dwarf planet Pluto. If you grew up learning that Pluto was actually a planet, you are not alone! As we journey to the outer edges of the solar system, we will examine the controversy over Pluto's reclassification as a dwarf planet from its former classification as our solar system's ninth planet.

What will you learn in this unit?

- Describe the characteristics of Uranus, Neptune, and the dwarf planets
- Understand how Uranus, Neptune, and the dwarf planets got their names
- Discuss how weight, mass, and gravity differ on Uranus, Neptune, and the dwarf planets
- Explain why Pluto is no longer classified as a true planet of the solar system

Astronomy 1B Midterm Exam

- Review information acquired and mastered from this course up to this point.
- Take a course exam based on material from the first four units in this course (Note: You will be able to open this exam only one time.)

Unit 5: The Sun

The Sun plays one of the most important roles in our solar system and certainly in life on Earth. In this unit, we will learn more about this closest star to Earth. We'll discuss the structure and composition of the Sun, including the different layers of the Sun's atmosphere. We'll also learn how the Sun creates energy through nuclear fusion and the process by which this takes place.

Finally, we'll learn more about solar weather and the events that take place in and around the Sun, including sunspots, solar flares, and coronal mass ejections.

What will you learn in this unit?

- Identify the five regions of the Sun.
- Discuss the structure and composition of the Sun.
- Learn about nuclear fusion in the Sun, including the proton-proton chain reaction.
- Examine solar activity, such as sunspots and solar flares.
- Define and discuss solar eclipses.

Unit 6: Comets, Asteroids, and Meteors

In this unit, we will examine comets, asteroids, and meteors. Although smaller than the Sun, Moon, and planets, these celestial bodies are an important part of our solar system. They can also produce dramatic visions in the Earth's skies and have the potential to collide with the Earth. We'll consider their composition, structure, and function in our solar system.

What will you learn in this unit?

- Define comet, asteroid, meteoroid, meteor, and meteorite.
- Examine the origin of comets and how their tails form.
- Discuss the location of asteroids in the solar system.
- Learn about the different types of meteorites.
- Investigate how comets, asteroids, and meteorites influence life on Earth.

Unit 7: Living and Working in Space

With space as vast as it is, it seems wrong that we are confined to just one planet. Sending equipment and satellites out into space is one thing, but sending people out into space is a whole other thing. What is it like to leave Earth? How do you brush your teeth in space? What will future space exploration look like? Let's prepare for this information in 20 seconds and counting….T-15 seconds, guidance is internal … 12, 11, 10, 9 … ignition sequence start …6, 5, 4, 3, 2, 1, 0 … all engines running … Houston; we have liftoff!

What will you learn in this unit?

- Explore space programs in countries around the world.
- Discover the International Space Station.
- Understand how spacesuits protect astronauts in the harsh outer space environment.
- Consider the daily realities of living and working in space.
- Examine the "New Space Race."

Unit 8: The Future of Space Travel

With all that we've learned about space explorations of the past—it's now time to look forward into the future. At the rate at which technology accelerates, we can really only begin to guess what the future of space exploration looks like, but we do know a few projects that are currently in the works, including a manned mission to Mars! Who knows, in a few years we might even be able to take a vacation through the stars!

What will you learn in this unit?

- Describe future plans for space travel and tourism from SpaceX and NASA
- Summarize locations in space that are most likely to harbor life
- Explore how computer technology supports space missions
- Analyze the role NASA plays in combating climate change

Astronomy 1B Final Exam

- Review information acquired and mastered from this course up to this point.
- Take a course exam based on material from units five to eight in this course – the last four units. (Note: You will be able to open this exam only one time.)