

Astronomy Unit: 9th Grade

Information about the Unit:

The following unit will be three weeks long. This unit will include notes and teacher notes on what will be needed. Each will contain a lab for the students to complete. Any videos used will be included. These include videos completed by the teacher for the notes. The standards are from North Carolina Essential Standards from Earth and Environmental Science.

Standards:

EEn.1.1 Explain the Earth's role as a body in space.

- EEn.1.1.1 Explain the Earth's motion through space, including precession, nutation, the barycenter, and its path about the galaxy.
- EEn.1.1.2 Explain how the Earth's rotation and revolution about the Sun affect its shape and is related to seasons and tides.
- EEn.1.1.3 Explain how the sun produces energy which is transferred to the Earth by radiation.
- EEn.1.1.4 Explain how incoming solar energy makes life possible on Earth.

Week 1:

Target Points:

Week Overview:

This week in class, you will be learning about how the Earth and Moon move in the Universe. You will explore Newton's Law of Inertia further and how it pertains to the Earth's rotation. You will discover information about the barycenter, nutation, and precession. You will be looking at new vocabulary in labs and your notes. Get buckled up for space exploration. We will be talking about Space and how the Earth moves in Space. We will be exploring this subject for the next three weeks.

Little Words from Your Instructor:

Class materials needed :

scissors, glue sticks, colored pencils, face masks, composition notebook, highlighters

Essential Questions for the Week:

1. How do you define rotation and revolution?
2. How does barycenter relate to the Earth's orbit?
3. What is the galactic path of the Earth?
4. How do Newton's Law of Inertia and gravitational law influence the Earth's path around the Sun?
5. How do precession, nutation, and barycenter influence Earth's motion in the solar system?

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I Can Statements...

- I can define revolution and rotation.
- I can describe the relationship between the barycenter and the Earth's orbit.
- I can describe the galactic path of the Earth.
- I can explain how inertia and gravity influence Earth's path around the Sun.
- I can describe Earth's motion through the solar system.

Learning Targets for the Week...

1. Define rotation and revolution.
2. Describe barycenter as it relates to the eccentricity of the Earth's orbit.
3. Trace the galactic path of the Earth.
4. Describe how Newton's law of inertia and gravitational law influence Earth's path around the sun.
5. Explain the Earth's motion through space, including precession, nutation, the barycenter, and its path about the galaxy.

HONORS

6. Examine the position of the foci as it relates to the changing elliptical shape

Vocabulary:

- revolution
- barycenter
- eccentricity
- foci
- nutation
- precession

The vocabulary you will start building Quizlets for each week we have the vocabulary. These Quizlets will be due every week (ONLY if we have a vocabulary that week.) You will have an assignment in Canvas that will let you know you have the vocabulary. This vocabulary will also be in our weekly quizzes. *REMEMBER* We signed up for Quizlet the first week you were in class.

Week 1: Rotation, Revolution, and Kepler Laws...

- **Time recommended: 1 to 3 days**
- **Today's Teacher Notes:**
 - Teachers can do this in a flipped classroom where the notes are given the night before. If completed as a flipped classroom, you can complete the Perfect Precession Picture in the class on Monday. If not, this must be extended to 2 to 3 days.
- **Bell Ringer:**
 - Why does the sun not pull you from your chair and out to space?
 - Answer the following question on a separate sheet of paper
- **I can statements:**
 - I can define revolution and rotation.
 - I can describe Earth's motion through the solar system.
- **Activities:**
 - **Notes:**

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- Today students will be working on notes for this week.
- [Notes: Presentation](#)
- **Activity: Think, Pair, and Share....**
 - Explain to the students what Think, Pair, and Share is. Use the following information on what the students will be talking about.
 - Precession, Nutation, and Barycenter...What do you know?
 - **Topic:**
 - What real-life examples could you compare precession, nutation, and barycenter? How do these objects differ from each other? Why did you choose those objects?
 - Walk around to ensure all students are participating in the activity.
- **Activity: Week 1 Notes: Fill-in-the-Blank**
 - [Standard 1.1.1 a-d notes](#)
- **Assignment:**
 - [Perfect Precession Picture](#)
 - Using the link above, you will need to set-up up your assignment. This lesson plan is for two 45-minute periods, so it could quickly be done in one class session.
 - Have the kids show their work and explain their video. This will be something fun for them to do.
- **Exit Ticket:**
 - Describe what the three different types of Kepler's Law are.
- **Precession and Nutation Follow-Up:**
 - After working on the notes, students can answer the following questions. Below you be given the option to ask questions that you still may have about the different vocabulary words or concepts.
 - Explain planetary orbits, especially that of the Earth, using Kepler's laws.
 - Explain the relative motion of the Earth in the solar system, the solar system in the galaxy, and the galaxy in the universe—including the expanding nature of the universe;
 - Orbital motion (Earth around the Sun- once/year, seasons depend upon an approximate 23.5-degree tilt); Rotation around our axis (day/night)
 - Explain Precession—change in the direction of the axis, but without any change in tilt—this changes the stars near (or not near) the Pole but does not affect the seasons (as long as the angle of 23.5 degrees stays the same)

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- Explain nutation—wobbling around the precessional axis (This is a change in the angle— $\frac{1}{2}$ degree one way or the other. This occurs over an 18-year period and is due to the Moon exclusively. This would very slightly increase or decrease the number of seasonal effects.)
- **Student Self-Check: Standard 1.1.1 a-d:**
 - Students can use this to review for a quiz at the end of the week.
 - [Earth's Rotation and Revolution](#)

Week 1: Barycenter:

- **Time Recommended: 1 day**
- **Today's Teachers Notes:**
 - Discuss from the notes how barycenter is connected to the nutation and precession before starting the lab.
 - Prep the lab materials the day before. You can prepare with little containers of Play-Doh, have the students do the lab individually and then answer the end of the lab questions together.
- **Bellringer:**
 - How does barycenter relate to the Earth's orbit?
 - What is the galactic path of the Earth?
 - Looking back at our notes and, in your own words, write down possible answers on a slip of paper on your desk.
- **I Can Statements:**
 - I can describe the relationship between the barycenter and the Earth's orbit.
 - I can describe the galactic path of the Earth.
- **Instructions:**
 - Students will be completing a lab activity with going into further detail about the Barycenter and what it is.
 - The teacher will need to make sure you have Play-Doh, small skewers (bigger than toothpicks), scales, string, 3x5 index cards, and scissors.
 - [Barycenter Lab](#)
- **Exit Ticket:**
 - Relate the Barycenter to precession and nutation. Noticing how they are linked. Teachers can create a comparison chart.
 - Barycenter...That is a thoughtful insight.
 - Why did people believe the Earth is the center of the solar system when it's obvious the sun is?
 - Why does everything in our galaxy orbit the supermassive black hole at the center?
 - **Final Activity: Exit Ticket:**
 - Review the notes, vocabulary, and how they relate to real-life examples. These would have been discussed in class. Using notes, photos, and videos.
 - [Barycenter: Review Sheet for the end of the week quiz](#)

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Week 1: Newton's Law of Inertia

- **Time Recommended: 1 Day**
- **Today's Teacher Notes:**
 - **Make sure to have different types of items available for this assignment. Such as baseballs, tennis balls, marbles, pieces of paper, jacks, and paper bags. Anything that will help with this project. This will help with the assignment and hands-on activity. After the activity, you will be able to review and then have them take the review quiz.**
- **Bellringer:**
 - What is the galactic path of the Earth?
 - How do Newton's Law of Inertia and gravitational law influence the Earth's path around the Sun?
 - Looking back at our notes and, in your own words, write down possible answers on a slip of paper on your desk.
- **I Can Statements:**
 - I can explain how inertia and gravity influence Earth's path around the Sun.
 - I can describe Earth's motion through the solar system.
- **Instructions:**
 - Review the notes for Newton's Gravitational Force; these were given on week 1.
 - You can use the following youtube view for a review and discussion:
 - [Newton's Law of Universal Gravitation](#)
 - Use the following activity for further review:
 - <https://studyjams.scholastic.com/studyjams/jams/science/forces-and-motion/fgravity-and-inertia.htm>
- **Activities:**
 - Tall of Man
 - The goal of Tall of Man is to determine the relationship between the acceleration due to gravity and the mass of an object.
 - **Directions:**
 - [Tall of Man](#) directions and instructions
- **Exit Ticket:**
 - Complete the following QUIZZ for review. [QUIZZ REVIEW](#)

Week 1: How are the Orbits' Shape and Seasons Determined...

- **Time Recommended: 2 Days**
- **Today's Teacher Notes:**

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- In the next two days, the class will go over why the Earth is shaped the way it is and why there are seasons. On day 9, students will go over notes for this section and complete a lab for the assignment on Day 10.
- **Bellringer:**
 - How does Earth's rotation and revolution about the Sun affect the Earth's shape?
 - How is the Earth's rotation and revolution related to seasons and tides?
 - Looking back out our notes and, in your own words, write down possible answers on a slip of paper on your desk.
- **I Can Statements:**
 - I can explain how Earth's rotation and revolution affect the shape of the Earth.
 - I can explain the relationship between season and rotation, and revolution.
 - I can explain the relationship between tides and rotation and revolution.
- **Activity: Instructions:**
 - Earth Seasons and Shape Mystery:
 - Discussing different factors that come into play in the shape of the earth and the seasons.
 - **What causes climate to change – and how much can it change?**
 - **How has life shaped Earth – and how has Earth shaped life?**
 - Give specific directions, including:
 - They will be responding to each other on their different interpretation of the vocabulary definitions. **Add the definitions to the question to help them decipher what real-world possibilities there are. You will need to jump in at times to keep the discussions going. I always have to respond to the kids' different thoughts about the questions. This can also be used as an activator or an exit ticket in a pinch. Delete everything in yellow.**
 - **Activity: Worksheet**
 - Describe how precession and nutation affect Earth's motion in space.
 - [Earth Seasons and Shape Mystery](#)
 - Earth Shape and Seasons Notes:
 - Discovery of the Seasons and the shape of the Earth.
 - [Day 3 Slides: Seasons and Tides](#)
 - Earth Shape and Seasons Activity:
 - This activity will go with the notes as well.
 - [Earth Shape and Seasons Webquest](#)
 - Week 1 Review Packet and Quiz:
 - Have the students complete the following review with a partner and a separate sheet of paper.
 - [Review Packet with Partner](#)

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- Have the students complete the quizzizz to help with the review as well. It is a 16-question quiz from standard 1.1.1 and standard 1.1.2. This will help with reviewing and seeing where you need to go back, reteach or find an activity to help them to understand the material better.
 - [Student practice quiz](#)
- **Exit Ticket:**
 - Each day the class will review the classwork through questions and discussions. The class will have a discussion question that they will need to respond to help with the different sections of the standards and review prior standards. This way, the class constantly cycles back through the information to help them keep it present for an upcoming test.
 - The weekly test will be taken at the end of each week. You can do a pre and post-test each week to see the progress. This will also give you data to help with where you need to circle back to for review.

Week 2: Earth and Universe:

- **Overview:**
 - **Nuclear Fission:**
 - A large splits into several small nuclei when impacted by a neutron, and energy is released.
 - **Nuclear Fusion:**
 - Several small nuclei fuse and release energy.
 - This week you will continue the search through the solar system in search of how the sun sends us our energy and how we can harness this energy. You will learn about fusion, fission, and the differences in class. You will explore the safe energy of solar power. You will review with your class for your first unit test next week. Get buckled up for space exploration.
- **Little Words from Your Instructor:**
 - **Class materials needed :**
 - scissors, glue stickers, colored pencils, face masks, composition notebook, highlighters
- **Essential Questions for the Week:**
 1. How does the Sun produce energy through the nuclear thermal fusion process?
 2. How does the Sun's core heat transfer to its surface? Energy transferred to Earth?
 3. What type of energy is transferred from the sun to the Earth?
 4. How does the sun produce energy and transfer it to Earth?
 5. What is the process of fusion for hydrogen to helium
- **I Can Statements...**
 - I can explain the Sun's process of nuclear thermal fusion.

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- I can describe the transfer of the Sun's core heat to its surface.
- I can explain how the Sun's energy is transferred to the Earth.
- I can describe the process of hydrogen and helium fusion
- **Learning Targets for the Week...**
 1. Describe the nuclear thermal fusion process of the Sun's core.
 2. Describe the transfer of the Sun's core heat to its surface.
 3. Describe the movement of energy from the Sun to the Earth.
 4. Explain how the Sun produces energy transferred to the Earth by radiation.

HONORS:

 5. Model the fusion of hydrogen to helium
- **Vocabulary:**
 - conversion
 - absorbed
 - radiate
 - cellular
 - insolation
 - photosynthesis
 - nuclear
 - thermal
 - fusion
 - core
- **Standards for the week:**
 - **EEn.1.1.3:** Explain how the sun produces energy transferred to the Earth by radiation.
- **Sun's Energy: Who, How, or What?: Lesson Plan**
 - I can statements:
 - I can explain the Sun's process of nuclear thermal fusion.
 - I can describe the transfer of the Sun's core heat to its surface.
 - I can explain how the Sun's energy is transferred to the Earth.
 - I can describe the process of hydrogen and helium fusion.

 - **Discussion Question: Directions:**
 1. You will respond to the answers in the text box below.
 2. After you respond, you will respond to two classmates. Your response needs to be 50 words in length
 - **Discussion Question:**
 - Describe what you know about nuclear fusion. How does it differ from nuclear fission? What ideas would you like to learn about the Sun's energy?
 - **Bellringer:**
 - Watch and read the following information to see and get examples of how humans are working on harnessing nuclear fusion.
 - Youtube: [Theory of Nuclear](#) Reactors
 - Applications of Nuclear Fusion:

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- We are still at an experimental stage as far as nuclear fusion reactions are concerned.
 - **Clean:** No combustion occurs in nuclear power (fission or fusion), so no air pollution exists.
 - **Less nuclear waste:** The [fusion reactors](#)
 - [Links to an external site.](#)
 - will not produce high-level nuclear wastes like their fission counterparts so disposal will be less of a problem. In addition, the wastes will not be of weapons-grade nuclear materials, as is the case in fission reactors.
- Nuclear fusion is the answer to the world's power crisis problem if appropriately utilized. It is clean and produces a minimal amount of nuclear waste compared to fission reactions. In addition, the fuel for fusion, Deuterium, and Tritium, are also readily available in nature. Thus, scientists are hopeful that fusion will be a viable alternative power source in the coming centuries.

Answer the following questions on a separate sheet of paper:

 1. What are the environmental effects of nuclear power?
 2. Does fusion create the same radioactive waste the same way that fission does?
 3. Can fusion causes a nuclear accident?
- **Nuclear Fusion: the Beginning:**
 - Bellringer:
 - Watch and read the following information to see and get examples of how humans are working on harnessing nuclear fusion.
 - [Understanding how it works](#)
 - After watching the video, what further questions do you have about a nuclear reactor?
- **Fusion and Fission Notes:**
 - [Powerpoint notes](#)
 - [Students Fill-in-Notes](#)
 - Exit Ticket for notes:
 - What is nuclear fusion? Using your answer on a separate sheet of paper.
- **MeteoAR Surface Activity:**
 - Using the link below, you will have a detailed description of what your students must do for this. You should walk them through the first directions to help them with this assignment.
 - [MeteoAR Surface Activity](#) Directions
 -
- **Nuclear Fusion Lab:**
 - This lab will help the students to visualize nuclear fusion using marshmallows, beans, and uncooked pasta as examples.

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- Using the following worksheet for detailed directions. You must ensure you have all the materials needed for this lab.
 - [Marshmallow Nuclear Lab](#)
- **Electromagnetic Spectrum:**
 - The following worksheet will review with the students over the Electromagnetic Spectrum...
 - Let the students know these are their notes for the Electromagnetic Spectrum. They can use the notes provided on Monday of this week and the internet as a scavenger hunt.
 - [Electromagnetic Spectrum Assignment](#)
- **Sun Energy Study Guide:**
 - Students will be able to start on their review for the Unit 1 Study guide by completing the following Quiziz.
 - Using the Following link, you can start a review for the Astronomy Unit test and data to see which standards the students need help understanding.
 - [Sun Energy Study Guide](#)
- **Discussion:**
 - Describe what you know about nuclear fusion. How does it differ from nuclear fission? What ideas would you like to learn about the Sun's energy?
 - Directions:
 - Give specific directions, including:
 1. You will respond to the answers in the text box below.
 2. After you respond, you will respond to two of your classmates. Your response needs to be 50 words in length.

Week 3: Earth and Universe: Overview

This week we are continuing our search through the solar system in search of how the sun sends us our energy and how we can harness this energy. In class, you will learn about fusion and fission and their differences. You will explore the safe energy of solar power. You will be reviewing for your first unit test this week. Get buckled up for space exploration. This is our last week, and we will take our test this week.

Little Words from Your Instructor:

Class materials needed:

scissors, glue sticks, colored pencils, face masks, composition notebook, highlighters

Essential Questions for the Week:

1. How does life on Earth absorb solar energy?
2. How does insulation make life possible on Earth?
3. How do plants respond to solar radiation intensity?
4. How is solar energy absorbed by life on Earth?
5. How does insulation make life possible on Earth?
6. How do plants respond to solar radiation intensity?

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I Can Statements....

- I can describe how solar energy is absorbed by life on Earth.
- I can explain how insulation makes life possible on Earth.
- I can explain the relationship between solar energy and life on Earth.

Learning Targets for the Week...

1. Describe how solar energy is absorbed by life on Earth.
2. Explain how the Earth's magnetic field protects the planet from the harmful effects of radiation.
3. Explain how incoming solar energy makes life possible on Earth.

HONORS:

4. Analyze plant response to solar radiation intensity.

Vocabulary:

- conversion
- absorbed
- radiate
- cellular
- insulation
- photosynthesis
- nuclear
- thermal
- fusion
- core

Standards for the week:

- EEn.1.1.4: Explain how incoming solar energy makes life possible on Earth.
- [Links to an external site.](#)

- Activities & Discussion:

- Discussion:

- Solar Energy
 - Solar Energy, what do you remember from Middle School about the Earth using the energy from the Sun?
- Answer the following questions in the reply box below by selecting reply. These discussion questions will be gone over in class as well. But you will need to type your answers first.
- Did you know that the sun can help us heat and light our homes, cook our food, and heat our water?
- Many other communities with access to coal, natural gas, oil, and wood have decided to use renewable energies such as solar power instead. Why?
- But just how much energy can we capture from the sun? What does it depend on?

- Activities:

- Today's lesson will give us an idea of how to use the Sun's energy and determine how much solar energy is available to us. Following the lesson, consider conducting the associated activity Solar Water:

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Heat it! (There will be an assignment in Canvas to use if you have time.) where students learn about the engineering design process as they design, build, and test flat-plate solar water heaters! Before starting the activity, review the following questions and see students' thoughts.

- Did you know that the sun can help us heat and light our homes, cook our food, and heat our water?
- Many other communities with access to coal, natural gas, oil, and wood have decided to use renewable energies such as solar power instead. Why?
- But just how much energy can we capture from the sun? What does it depend on?
- **Solar Energy: When and Where is it the Best?**
 - Today's lesson will give us an idea of how to use the Sun's energy and determine how much solar energy is available to us.
 - Assignment Instructions:
 - Using the PowerPoint given below. This will give you background information and will go over the directions in detail on what you are to do. Please, ask your teacher if you have any further questions regarding the assignment.
 - [Solar Power Energy Powerpoint Notes](#)
 - [Solar Power Energy Estimation](#)
- **Solar Energy and Life on Earth Notes, Essential Question & Bellringer**
 - **Bellringer:**
 - **The _____ is Earth's primary source of energy.** It emits an enormous amount of _____ **in the form** of electromagnetic _____ that travels through space.
 - Earth, located about 93 million miles (150 million kilometers, 1 astronomical unit) away from the Sun, receives a portion of that energy. Earth's climate is powered by sunlight, which drives atmospheric and ocean circulation and makes the planet hospitable to life.
 - **Essential Questions:**
 - How is solar energy absorbed by life on Earth?
 - How does insulation make life possible on Earth?
 - How do plants respond to solar radiation intensity?
 - **Notes:**
 - [Solar Energy and Life on Earth Notes powerpoint](#)
 - [Solar Energy and Life on Earth Notes](#)
 - **Assignment:**
 - How does life on Earth absorb solar energy?

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- How does insulation make life possible on Earth?
 - How do plants respond to solar radiation intensity?
 - **Insolation Lab:**
 - The following lab will show the students that, at different times during the year, the changes in the temperature. How is this temperature determined? Why is there a temperature variation? What changes the different temperature variation?
 - Using the following sheets, work through the assignment and learn how the earth travels around the sun and the different positions in which sunlight is present. Read the following article about insolation. This article will help you with this assignment.
<https://energyeducation.ca/encyclopedia/Insolation>
 - [Insolation Lab](#)
 - **Exit Ticket:**
 - What did you think about the assignment? What questions do you still have about today's assignment? Using a slip of paper from your table, write your thoughts on it. If you need (**Insert your name here**) help or have further questions, please write your name on the back for further conversation with me.
 - **You can have the students give you feedback about what they thought was difficult about the activity and what they learned and need further information about.**
 - **Unit Review:**
 - You can review questions for each section using the Quizizz given to you throughout the last three weeks.
 - The following will be used in class for review. The following Quizlets will help you prepare the vocabulary and subject matter.
 - [Astronomy Flashcards](#)
 - [Universe Quizlet](#)
 - [Kepler's Law of Planetary Motion](#)
 - [Planetary Motion](#)
 - [Planetary](#)
 - Use the following Quizizz to help you practice for Standard 1.1.4 for the Unit 1 Quest...
 - [1.1.4 Review Questions](#)
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