# 05 The Stars

Content Area: **Science**
Course(s): **CP Astronomy**
Time Period: **Marking Period 1**
Length: **3-4 weeks**
Status: **Published**

## Course Pacing Guide

Since the dawn of man, humans have been on a quest to understand who we are. At its most basic level, this quest is inextricably linked to a desire to discover how the universe is put together, how it works, and what our place is in it. In this course, we will explore the science that guides the phenomena we observe in the natural world as we stand on our Planet Earth and gaze into the furthest expanses of the universe. As we journey through the cosmos, we will also explore the social, historical, and philosophical impacts of scientific exploration.

| Unit | MP/Trimester | Weeks |
|---|---|---|
| A Cosmic Perspective | 1 | 4 |
| The Daytime and Nightime Sky | 1 | 4 |
| The Space Program | 1-2 | 2 |
| The Solar System | 2 | 3 |
| The Stars | 2 | 3 |
| The Universe | 2 | 2 |

## Unit Overview

In this unit, we study the formation and evolution of stars. We examine their properties and how we learn about those properties through the light we see. Using knowledge from chemistry, we learn how the electromagnetic spectrum applies to astronomy.

## Enduring Understandings

- In order to explore a complete picture of our universe, we observe radiation at all wavelengths.
- The atoms that make up our bodies were recycled in stars billions of years ago.
- Although women were not permitted to earn advanced degrees in astronomy well into the 20th century, they played a major role in shaping what we know and can learn from stars.
- A star's lifespan is determined by its mass. More massive stars use energy more quickly.

- The energy source of a star is the fusion of lighter elements into heavier ones.

Students will know:

- Light consists not only of the (visible) light we see but rather an entire range of radiation, from radio waves to gamma rays.
- Luminosity is a measure of the energy output of an obejct in a specified time interval.
- Light obeys an inverse-square law.
- Stars are powered by the conversion of hydrogen into helium in a process called nuclear fusion.
- Protons and neutrons reside in the nucleus of an atom. Electrons orbit the nucleus at discrete levels.
- When an electron moves from one level to another, it emits or absorbs energy (in the form of light which we can observe).
- The Sun is just one of over a hundred billion stars in the Milky Way galaxy. It is average in almost all measurable characteristics.
- When a massive star reaches the end of its life cycle, it explodes as a supernova and leaves behind a neutron star or black hole.

Students will be able to:

- Create and analyze an H-R diagram to aid in explaning the life cycles of stars of different masses.
- Analyze simple spectra and predit the elements contained in a given spectrum.
- Identify various types of stellar remnants.
- Use diffraction gratings to look at and analyze spectra.

## Essential Questions

- Where do the elements come from?
- How do we learn about stars if we can't visit them?
- How are stars born? How do they live? How do they die?
- What role do stars play in the overall structure of the universe?
- What characteristics determine the evolutionary path of a star?

## New Jersey Student Learning Standards (No CCS)

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|---|---|
| 9-12.HS-ESS1-1 | Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy that eventually reaches Earth in the form of radiation. |
| 9-12.HS-ESS1-3 | Communicate scientific ideas about the way stars, over their life cycle, produce elements. |
| 9-12.HS-ESS1-1.3.1 | students understand the significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. They recognize patterns observable at one scale may not be observable or exist at other scales, and some systems can only be |

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| | studied indirectly as they are too small, too large, too fast, or too slow to observe directly. Students use orders of magnitude to understand how a model at one scale relates to a model at another scale. They use algebraic thinking to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). |
| 9-12.HS-ESS1-4.5.1 | Use mathematical or computational representations of phenomena to describe explanations. |
| 9-12.HS-ESS1-2.6.1 | Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. |
| 9-12.HS-ESS1-1.PS3.D.1 | Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. |
| 9-12.HS-ESS1-2.PS4.B.1 | Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. |
| 9-12.HS-ESS1-2.ESS1.A.1 | The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. |
| 9-12.HS-ESS1-1.ESS1.A.1 | The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. |

## Amistad Integration

## Holocaust/Genocide Education

## Interdisciplinary Connections

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|---|---|
| MA.N-Q.A | Reason quantitatively and use units to solve problems. |
| LA.RST.11-12.2 | Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| LA.SL.9-10.1 | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. |

## Technology Standards

List specific standards that are relevant
No general statements

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| TECH.8.1.12.A.CS1 | Understand and use technology systems. |

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| TECH.8.1.12.A.CS2 | Select and use applications effectively and productively. |
| TECH.8.1.12.E.CS2 | Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. |
| TECH.8.1.12.E.CS3 | Evaluate and select information sources and digital tools based on the appropriateness for specific tasks. |

## 21st Century Themes/Careers

| | |
|---|---|
| CRP.K-12.CRP4 | Communicate clearly and effectively and with reason. |
| CRP.K-12.CRP11 | Use technology to enhance productivity. |

## Financial Literacy Integration

## Instructional Strategies & Learning Activities

1. Properties of Stars: Graphing Activity and Questions
2. Stellar Evolution: Guided Notes and Discussion
3. Electromagnetic Spectrum: Demonstration, Guided Notes, and Discussion
4. Cosmos Episode: "Sisters of the Sun" with questions
5. Constellation Project
6. Study Guide
7. Jeopardy Review Game
8. Unit Test

## Differentiated Instruction

Examples may include:

- Inquiry/Problem-Based Learning
- Variety of learning preferences (visual, auditory, kinesthetic)
- Meaningful Student Voice & Choice
- Self-Directed Learning
- Debate
- LMS use
- The Hot Seat/Role-Play
- Mastery Learning (feedback toward goal)
- Simulation-Based Learning
- Grouping
- Socratic Seminar
- Rubrics
- Concept Attainment

- Assessment Design & Backwards Planning

## Formative Assessments

- Various Do-Now Activities
- Observation
- Question and answer
- Informal check-ins

## Summative Assessment

Constellation Project

Unit test

## Benchmark Assessments

## Alternate Assessments

## Resources & Technology

- Astronomy Picture of the Day
- Episode of *Cosmos*: "Sisters of the Sun"
- Gas discharge tubes and power source
- Google Slides and internet research for project

## BOE Approved Texts

none

## Closure

Such as:

- Gallery Walk - On chart paper, small groups of students write and draw what they learned. After the completed works are attached to the classroom walls, others students affix post-its to the posters to extend on the ideas, add questions.
- Low-Stakes Quizzes - Give a short quiz using technologies like Kahoot or a Google form.
- Have students write down three quiz questions (to ask at the beginning of the next class).
- Question Stems - Have students write questions about the lesson on cards, using question stems framed around Bloom's Taxonomy. Have students exchange cards and answer the question they have acquired.
- Kids answer the following prompts: "What takeaways from the lesson will be important to know three years from now? Why?
- Ask a question. Give students ten seconds to confer with peers before you call on a random student to answer. Repeat.
- Have kids orally describe a concept, procedure, or skill in terms so simple that a younger student would understand it.
- Kids write notes to peers describing what they learned from them during class discussions.

## ELL

Such as:

- Alternate Responses
- Advance Notes
- Extended Time
- Teacher Modeling
- Simplified Written and Verbal Instructions
- Frequent Breaks
- E-Dictionaires
- Google Translate

## Special Education

List is not inclusive but may include examples such as:

- Shorten assignments to focus on mastery of key concepts.
- Specify and list exactly what the student will need to learn to pass.
- Evaluate the classroom structure against the student's needs (flexible structure, firm limits, etc.).
- Keep the classroom quiet during intense learning times.
- Provide a computer for written work.
- Seat the student close to the teacher or a positive role model.

- Provide an unobstructed view of the chalkboard, teacher, movie screen, etc.
- Keep extra supplies of classroom materials (pencils, books) on hand.
- Give directions in small steps and in as few words as possible.
- Number and sequence the steps in a task.
- Have student repeat the directions for a task.
- Provide visual aids.
- Go over directions orally.
- Provide a vocabulary list with definitions.
- Permit extra time as indicated in IEP.
- Allow tests to be taken in a room with few distractions (e.g., the library).
- Have test materials read to the student, and allow oral responses.
- Divide tests into small sections of similar questions or problems.
- Show a model of the end product of directions (e.g., a completed math problem or finished quiz).
- Stand near the student when giving directions or presenting a lesson.

## 504

Examples of accommodations in 504 plans include but are not limited to:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

## At Risk

Examples may include:

- Use of mnemonics
- Have student restate information
- Concrete examples
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
- No penalty for spelling errors or sloppy handwriting
- Teach time management skills
- Verbal and visual cues regarding directions and staying on task
- Adjusted assignment timelines
- Immediate feedback

- Work-in-progress check
- Pace long-term projects
- Preview test procedures
- Cue/model expected behavior

## Gifted and Talented

Focus on effort and practice

Offer the Most Difficult First

Offer choice

Speak to Student Interests

Allow G/T students to work together

Encourage risk taking