COURSE TITLE

Astronomy

LENGTH

One Semester

DEPARTMENT

STEM Department

SCHOOL

Union Middle School

Primary Content

Science

Initial Board of Education Approval Date (Born on): August 23, 2021

Embedded Content

Career Readiness, Life Literacies and Key Skills

Initial Board of Education Approval Date (Born on): August 23, 2021

Astronomy

I. Introduction/Overview/Philosophy

Students will explore topics pertaining to Earth's relationship with other planets, the sun, and places outside of our solar system. Students will be exploring the laws and theories of Isaac Newton, Galileo, Albert Einstein, Stephen Hawking and other astronomy scientists. We will be looking at the history of our planet and how it has become the current place we call home. The history of NASA, current events in space exploration, the search for life outside of Earth, and the future of space flight will also be studied.

II. Objectives

Course Outline:

1. Origin of the Universe and Earth Formation
2. Earth, Sun and Moon Relationships
3. Famous Space Scientists
4. History of NASA
5. The Sun
6. Planets
7. Comets, Meteors, and Asteroids
8. Space X
9. Stars and Black Holes
10. Current Space Explorations

Student Outcomes:

After successfully completing this course, the student will:

- Exploration of astronomy terms and theories
- Hands-on activities to understand Newtonian physics (laws of motion, universal gravitation, and orbital motion).
- Understand history and life cycle of the types of stars, how they produce energy through fusion, with an emphasis on our closest star – the sun.
- The importance of the sun for life as we know it.
- History of the planet Earth from its formation, to its development of liquid water, and how life possibly began in our oceans.
- Examine the earth-sun-moon relationship while being able to explain tides, eclipses, and phases of the moon.
- Investigate the important Earth features that allow it to sustain life as compared to other planets.
- Explore the characteristics of each planet in our solar system.
- Focus on Mars and how it is the only likely place besides the moon that humans can visit in the future.
- Learn the history of our space program, famous astronauts, space milestones, our "space race" with Russia, NASA, the space shuttles, and the details of the Apollo missions.
- Follow current events about space travel and rocketry, in particular the progress of private companies such as Space X.
- Explain the theory behind black holes and our recent evidence that they do exist.

New Jersey Student Learning Standards

SCIENCE

MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
MS-PS2-5 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.
MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

COMPANION STANDARDS FOR SCIENCE AND TECHNICAL SUBJECTS

RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.
RST.6-8.5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
RST.6-8.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
RST.6-8.8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
RST.6-8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

WHST.6-8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

CAREER READINESS, LIFE LITERACIES, AND KEY SKILLS PRACTICES

CRLLKSP 1 Act as a responsible and contributing community members and employee.
Students understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRLLKSP 2 Attend to financial well-being.
Students take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

CRLLKSP 3 Consider the environmental, social and economic impacts of decisions.
Students understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRLLKSP 4 Demonstrate creativity and innovation.
Students regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRLLKSP 5 Utilize critical thinking to make sense of problems and persevere in solving them.
Students readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRLLKSP 6 Model integrity, ethical leadership and effective management.
Students consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and

actions of a team or organization, and they apply insights into human behavior to change others' actions, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRLLKSP 7 Plan education and career paths aligned to personal goals.
Students take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRLLKSP 8 Use technology to enhance productivity, increase collaboration and communicate effectively.
Students find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRLLKSP 9 Work productively in teams while using cultural/global competence.
Students positively contribute to every team, whether formal or informal. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

III. Proficiency Levels

Astronomy is a semester elective course appropriate for all grade 7 and 8 students. .

IV. Methods of Assessment

Student Assessment
Assessment at this level falls into two categories: formative and summative. Formative assessments include teacher observations, work in student journals, lab reports, and performance-assessment tasks. Summative assessments demonstrate the extent and depth of learning. End of the module assessments and portfolios of accumulated work could serve as tools for this type of evaluation.

Curriculum/Teacher Assessment
The teacher will provide the subject area supervisor with suggestions for changes on an ongoing basis.

V. Grouping

This is a middle school elective course offered to students in grade 7 and grade 8.

VI. Articulation/Scope & Sequence/Time Frame

Course length is one semester.

VII. Resources

Texts/Supplemental Reading/References

Resources include but are not limited to: online resources, interactive models, documentaries, hyperdocs, etc.

VIII. Suggested Activities

Appropriate activities are listed in the curriculum map.

IX. Methodologies

The following methods of instruction are suggested: lecture, group projects, demonstration, hands-on applications, lab activities, and class presentations.

X. Interdisciplinary Connections

The primary focus of this course is to allow students to connect concepts learned in the regular science classroom to activities and situations in the real world. Applications to other disciplines will be made on a daily basis through a variety of projects and explorations.

XI. Differentiating Instruction for Students with Special Needs: Students with Disabilities, Students at Risk, English Language Learners, Students with a 504 Plan, and Gifted & Talented Students

Differentiating instruction is a flexible process that includes the planning and design of instruction, how that instruction is delivered, and how student progress is measured. Teachers recognize that students can learn in multiple ways as they celebrate students' prior knowledge. By providing appropriately challenging learning, teachers can maximize success for all students.

Differentiating in this course includes but is not limited to:

Differentiation for Support (ELL, Special Education, Students at Risk, Students with a 504 Plan)

- Peer mentoring on problems
- Differentiated teacher feedback on assignments
- Modeling out problems on whiteboard
- Visual aids as we project problems on whiteboard
- Study guides
- Tiered assignments
- Scaffolding of materials and assignments
- Re-teaching and review

- Guided note taking
- Exemplars of varied performance levels
- Multi-media approach to accommodating various learning styles
- Word Wall
- Visual Aides
- Assistive Technology
- Extended Time

Differentiation for Enrichment

- Supplemental reading material for independent study
- Flexible grouping
- Tiered assignments
- Topic selection by interest
- Enhanced expectations for independent study
- Elevated questioning techniques using Webb's Depth of Knowledge matrix

XII. Professional Development

The teacher will continue to improve expertise through participation in a variety of professional development opportunities.

XII. Curriculum Map/Pacing Guide

Unit Topic	**Time Allocated**	**Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, Students with a 504 Plan, & Gifted & Talented Students**	**Standards**	**Assessments**
Origin of the Universe and Earth formation. ● The Early astronomers Newton, Galileo, Copernicus, Brahe ● Early models and theories	2 weeks	*For Support:* ● Consistently review/enforce class expectations orally ● Provide oral reviews of main concepts using index cards or review cards ● Assist students in small groups ● Prompt students before writing task by asking questions to brainstorm, *For Enhancement:* ● Real World application of material ● Modeling ● Inquiry based instruction	MS-ESS1 RST.6-8.4	*Formative Assessment:* ● Discussion ● Classwork ● Group work ● EdPuzzle *Summative Assessment* ● Homework ● Quizzes ● Presentations ● Project- 3D Models
Earth, Sun, Moon relationship ● Eclipses, tides, phases ● Gravity, inertia, Newtonian physics terminology, moon features	6 weeks	*For Support:* ● Modify assessments, quizzes and/or homework if need be, ● Provide extended time on tasks, ● Re-read questions with rephrasing, ● Review projects/ideas individually with students to check for understanding ● Provide additional help/review after school *For Enhancement:* ● Real World application of material ● Inquiry based instruction ● Student Choice	MS-ESS1 MS-PS2 RST.6-8.4	*Formative Assessment:* ● Discussion ● Classwork ● Presentations ● EdPuzzles *Summative Assessment* ● Homework ● Quizzes ● Tide Lab ● Storyboard Project ● Moon Phase Project
Famous Space Scientists ● Einstein	1 week	*For Support:* ● Provide assistance with note-taking	MS-PS2 RST.6-8.4	*Formative Assessment:* ● Discussion

● Sagan ● Hawking		● Modify assessments, quizzes and/or homework ● Provide extended time on tasks, re-read questions with rephrasing ● Provide completed notes with key ideas outlined (if necessary) *For Enhancement:* ● Real World application of material ● Extension Activities ● Inquiry based instruction ● Student Choice	RST.6-8.5 RST.6-8.6 RST.6-8.8 RST.6-8.10	● Classwork ● Questioning *Summative Assessment* ● Presentations
Space Race ● History of NASA	1 week	*For Support:* ● Provide assistance with note-taking, ● Consistently review/enforce class expectations orally ● Provide oral reviews of main concepts using index cards or review cards *For Enhancement:* ● Real World application of material ● Modeling ● Inquiry based instruction	MS-PS2 RST.6-8.4 RST.6-8.5 RST.6-8.6 RST.6-8.8 RST.6-8.10	*Formative Assessment:* ● Discussion ● Classwork ● Group work ● EdPuzzle ● Presentations *Summative Assessment* ● Homework ● Labs on Rocket Balloons and Problems in Space ● Quiz
The Sun	1 week	*For Support:* ● Assist students in small groups Provide extended time on tasks, Activate prior knowledge and prompting while completing their “Do Now” ● Rephrase any reading material when needed *For Enhancement:* ● Independent study ● Real World application of material ● Modeling ● Inquiry based instruction	MS-ESS1 RST.6-8.4	*Formative Assessment:* ● Discussion ● Classwork ● EdPuzzle *Summative Assessment* ● Homework ● Quizzes ● Presentations

Inner Planets ● Mercury ● Venus ● Mars	1 week	*For Support:* ● Assist students in small groups ● Provide extended time on tasks ● Re-read questions with rephrasing ● Review projects/ideas individually with students to check for understanding *For Enhancement:* ● Real World application of material ● Pacing ● Inquiry based instruction	MS-ESS1 RST.6-8.4	*Formative Assessment:* ● Discussion ● Questioning ● Classwork ● Group work ● Shared reading *Summative Assessment* ● Homework ● Quizzes ● Labs ● Tests
Earth	1 week	*For Support:* ● Provide oral reviews of main concepts using index cards or review cards ● Assist students in small groups *For Enhancement:* ● Extension Activities	MS-ESS1 RST.6-8.4	*Formative Assessment:* ● Discussion ● Classwork ● Group work ● Shared reading ● Questioning *Summative Assessment* ● Presentations
Outer Planets ● Jupiter ● Saturn ● Uranus ● Neptune	2 weeks	*For Support:* ● Provide oral reviews of main concepts using index cards or review cards ● Assist students in small groups ● Re-read questions with rephrasing Activate prior knowledge and prompting while completing their “Do Now” *For Enhancement:* ● Real World application of material ● Modeling ● Student Choice ● Extension Activities	MS-ESS1 RST.6-8.4	*Formative Assessment:* ● Discussion ● Classwork ● EdPuzzle *Summative Assessment* ● Homework ● Quizzes ● Presentations ● Labs ● Solar System Models
Comets, Meteors, and Asteroids	2 weeks	*For Support:* ● Assist students in small groups ● Provide extended time on tasks ● Re-read questions with rephrasing	MS-ESS1 RST.6-8.4	*Formative Assessment:* ● Discussion ● Classwork ● EdPuzzle

		● Review projects/ideas individually with students to check for understanding ● Provide completed notes with key ideas outlined (if necessary) *For Enhancement:* ● Real World application of material ● Pacing ● Inquiry based instruction		*Summative Assessment* ● Homework ● Presentations
Space X	1 week	*For Support:* ● Provide assistance with note-taking ● Provide oral reviews of main concepts using index cards or review cards ● Activate prior knowledge and prompting while completing their "Do Now" *For Enhancement:* ● Extension Activities ● Inquiry based instruction ● Student Choice	MS-ESS1 RST.6-8.5 RST.6-8.6 RST.6-8.8 RST.6-8.10	*Formative Assessment:* ● Discussion ● Classwork ● EdPuzzle *Summative Assessment* ● Homework ● Presentations
Stars, Lifecycles, and Black Holes	1 week	*For Support:* ● Provide one to one direction/clarification of instructions if needed, ● Monitor on task performance ● provide/use graphic organizers for notes ● Provide visual aides ● monitor on task performance. Provide completed notes with key ideas outlined (if necessary) *For Enhancement:* ● Modeling ● Inquiry based instruction	MS-ESS1 RST.6-8.4	*Formative Assessment:* ● Discussion ● Classwork ● EdPuzzle *Summative Assessment* ● Homework ● Presentations
Current Space Exploration and Discoveries, and Special Telescopes ● Search for life elsewhere in our solar system/universe	1 week	*For Support:* ● Consistently review/enforce class expectations orally	MS-ESS1 MS-PS2 MS-PS3 RST.6-8.5	*Formative Assessment:* ● Discussion ● Classwork ● EdPuzzle

		● Provide oral reviews of main concepts using index cards or review cards ● Assist students in small groups ● Prompt students before writing task by asking questions to brainstorm, *For Enhancement:* ● Real World application of material ● Modeling ● Inquiry based instruction	RST.6-8.6 RST.6-8.8 RST.6-8.10	*Summative Assessment* ● Homework ● Presentations