Unit 1: Scientific Investigation, Measurement and Space Systems

Content Area: **Science**
Course(s):
Time Period: **Trimester 1**
Length: **10-12 weeks**
Status: **Published**

Brief Summary of Unit

Unit Introduction: Scientific Investigation, Measurement, and Space Systems
In this unit, students will build a strong foundation in scientific inquiry by mastering the scientific method, distinguishing between observations and inferences, and designing controlled experiments. They will learn to identify independent, dependent, and controlled variables, develop testable hypotheses, and accurately collect and interpret data. Students will communicate their findings through clear and comprehensive lab reports that reflect sound reasoning and the effective use of evidence. Students will review lab safety protocols to ensure safe practices and demonstrate success when doing lab activities.

Students will also gain proficiency in using scientific tools to make accurate measurements. They will measure length in millimeters, centimeters, and meters, volume using graduated cylinders, and mass using triple-beam and electronic balances. Emphasis will be placed on using appropriate units in the metric system and on converting between metric and imperial systems.

Building on these foundational skills, students will investigate the structure and components of the solar system, including the Sun, planets, moons, and other orbiting bodies. They will explore how gravity and inertia work together to keep celestial bodies in orbit, and how mass and distance affect gravitational force. Students will examine the formation and characteristics of stars, the role of nebulae, and the structure of galaxies and other space phenomena.

Through modeling and data analysis, students will gain an understanding of the scale of the solar system and the universe. They will explore how Earth's rotation and revolution cause observable patterns such as day and night, seasons, moon phases, eclipses, and tides.

Students will engage in Science and Engineering Practices such as developing and using models, analyzing and interpreting data, planning and carrying out investigations, and constructing explanations based on evidence. They will use diagrams, data tables, and models to support understanding.

Revision Date: July 2025

Essential Questions/Enduring Understandings

Essential Questions

What are the defining characteristics of objects in our solar system, and how do they interact?

How do gravity and inertia influence the motion of objects in space?

What role do stars, nebulae, and galaxies play in the structure of the universe?

How can models and technology help us understand and explore the vast scale of the solar system and the universe?

What patterns can we observe in space, and what do they tell us about cause and effect?

Enduring Understandings

The solar system is made up of the sun, planets, moons, and other orbiting bodies, each with unique properties and characteristics.

Gravity and inertia work together to govern the motion of objects in space, such as planets orbiting the sun and moons orbiting planets.

Stars are the fundamental building blocks of galaxies, and their life cycles begin in nebulae and follow predictable stages.

Understanding the scale of space requires the use of models and technology to represent vast distances and sizes.

Systems thinking, recognizing patterns, and understanding cause and effect help scientists make sense of complex phenomena in space.

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Students will Know/Students will be Skilled At

Scientific Method and Skills

Students will be skilled at practicing proper lab safety.
Students will be skilled at planning and carrying out investigations using the scientific method to answer testable questions.

Students will know the difference between qualitative observations and inferences.

Students will be skilled at formulating hypotheses and testing them through experimental design.

Students will know how to identify and apply independent, dependent, and controlled variables in scientific investigations.

Students will be skilled at collecting, analyzing, and interpreting data using appropriate graphical representations.

Students will be skilled at constructing lab reports that communicate the problem, hypothesis, procedures, results, and evidence-based conclusions.

Measurement and Tools
Students will be skilled at accurately measuring length using millimeters, centimeters, and meters.

Students will be skilled at measuring volume with a graduated cylinder and mass with triple-beam and electronic balances.

Students will know the appropriate units of measurement in the metric system.

Students will be skilled at comparing and converting between metric and imperial measurement systems.

Students will be skilled at selecting and using scientific tools and technology to gather, analyze, and communicate data.

Earth and Space Science
Students will know the hierarchical structure of the universe, including stars, planets, moons, solar systems, galaxies, and the universe itself.

Students will know current scientific theories and models that explain the formation of the solar system, Earth, and the Moon.

Students will know how Earth's rotation causes day and night, and how revolution and axial tilt cause seasonal changes.

Students will be skilled at comparing and contrasting Earth's rotation and revolution and modeling their effects on Earth's cycles.

Students will be skilled at modeling the Moon's rotation and revolution and explaining their relationship to moon phases.

Students will know the 8 phases of the Moon and the pattern in which they occur.

Students will be skilled at modeling and explaining solar and lunar eclipses through Sun-Earth-Moon alignment.

Students will know how the gravitational pull of the Moon causes tides on Earth.

Students will know and be able to compare the physical and orbital characteristics of the 8 planets in our solar system.

Learning Plan

Observation vs. Inference: Students view a series of pictures and make observations only. Share/discuss. Then, students will make inferences based on their initial observations. Share/discuss and repeat with 3 different pictures. Students will then view fossil evidence on the smart board and make as many observations as possible. Homework: to create a short story based on the fossil evidence and observations from class

Paper Planes Practice Lab: Students will perform a practice lab to help teach them the basic parts of a lab

procedure. Students will build a paper airplane, test the flight, modify the airplane, and then test again. While going through these steps, students will be asked questions about the fairness of the lab and certain things that should be done to make the lab a success. Students will fill in a lab worksheet during class and then attempt to define lab-related words based on what they experienced during the lab. *Class Discussion: How can we make a lab "fair"? What steps should we always follow when setting up a lab? Why should we conduct many trials in the same lab? How do variables and constants affect a lab?*

Hypothesis Writing: Does anyone know what a hypothesis is? Give examples and demonstrate on the board. Students will take notes on how to write a good hypothesis. Students will practice as a class with examples on the smart board and go over answers together. Partner work: practice worksheet with hypothesis examples. Students will share answers. Homework: Writing a good hypothesis worksheet

Mixing Solutions Lab: Students will perform a lab to put into practice the skills and terms learned in the previous practice lab, class discussion, and practice with hypothesis writing. Students will conduct a lab to test the effect of calcium chloride on water temperature. Students will follow all lab procedures, write a hypothesis, and collect and analyze data. Students will complete a lab handout while performing a lab, as well as complete analysis questions when they are done. *Class Discussion: Use the analysis questions to start class discussion about the lab and to introduce the idea of possible sources of error.*

Tennis Ball Assessment: Students are given the scenario of figuring out which brand of tennis ball bounces the highest. Students will then write up a lab in their binders that includes a problem, hypothesis, materials, and procedure. The teacher will observe and formatively assess students. When complete, students will share/check their labs with their table to see if they did everything correctly.

Variables: Demonstration- redo the tennis ball experiment from yesterday and have students pick out variables. (things that are different amongst the test groups) Examples on the smartboard, students discuss answers, and take notes on how to identify dependent and independent variables. Partner Work - Practice worksheets identifying variables. Students share answers with the class. Homework: Identifying variables in a hypothesis and in an experiment.

Putting it all together: students will practice each skill separately again as a review and share with the class. Students will then practice writing a hypothesis, picking out the variables and the controls. Share with the class. Add procedure & data collection to experiment layout. Homework: writing a hypothesis, identifying controls and variables.

Conclusion: What is a conclusion? What goes in one? Why is the conclusion important? Discuss answers and take notes on what must be included in a lab report conclusion. Students will make a bulleted list of key points for writing a good conclusion. Skill Practice – students will be given experiment scenarios, and they will have to add an appropriate conclusion to the scenarios. Go over conclusions in class & have students make corrections. Repeat, but this time have partners correct each other's conclusions as the teacher circulates the classroom to facilitate. Homework: practice conclusion writing

Graphing: Review pre-assessment, students will make corrections and keep in their binder as a reference. Discuss graphing requirements and take notes. Hand out the graphing rubric for all graphs, and have students review and keep in a binder to use every time they make a graph. Group work – students will work with a table to construct a practice graph and go over it with the class when finished. Homework: graphing practice.

Tennis Ball Lab: Students will work in partners to complete the lab. Each student will squeeze a tennis ball to test grip strength over time. Students will record each other's data and complete the lab handout with questions. Students will create a double line graph with both students' data. Review lab and graphing.

Bean Lab: Students will work in partners to create, set up, and perform a lab experiment in class. Students will collect and analyze data and then write a complete lab report. Students will test the effects of a substance of

their choice on bean growth. This lab spans 3 days, including preparation, set-up, data collection, and some class time to begin writing the report.

Introduction to Metric System: students complete a brainteaser to introduce the metric system and get an "ah-ha" moment about the ease of the metric system over the U.S. system. Students will then complete the back of the worksheet on their own first & then brainstorm with their table for more answers. Class discussion on different units of measurement for the U.S. versus the Metric system.

View the PowerPoint, discuss, & take notes on the Metric System to go along with the activity. End of PowerPoint: practice activity to assess knowledge via smartboard.

Worksheet (homework) – practice with metric units and measurements, **peer check with table, answers eventually on board for student support**

Measurement Skills: The Teacher will demonstrate the use of a Ruler, a graduated cylinder, a triple beam balance, and an electric balance. Students will first practice each skill via worksheets and then complete a lab activity to practice hands-on skills with each tool.

Length Lab: Teacher will demonstrate how to accurately measure to the nearest decimal using a ruler & meter stick. Students will follow along on their ruler & participate in questioning. Students will then complete a basic worksheet on using a ruler and measuring to the nearest decimal.

Then, students will complete the lab activity. Students will measure the length of different objects around the room & record their observations. Students will be assessed on their accuracy and may work with/help their table partners. **more advanced students instruct lower level**

Volume Lab: The Teacher will demonstrate how to accurately measure volume using a graduated cylinder. Students will follow along on the graduated cylinder per the table & participate in questioning. Students will be advised to look closely and make observations about the water in the graduated cylinder, which should lead to a discussion about the meniscus. Students will then complete a worksheet to ensure basic understanding of measurement using a graduated cylinder.

Then, students will complete the lab activity. Students will practice measuring out different amounts of liquid as well as finding the volume of different objects using a graduated cylinder. Students will be assessed on their accuracy & will participate in class discussion on the lab. **Use of graduated cylinders and scales will be used by all students**

Mass Lab: Teacher will demonstrate how to accurately measure mass using a triple beam balance and an electronic balance. Students will follow along on the balances at their tables & participate in questioning. Students who catch on quickly will be asked to guide & teach the other students at their table. Students will complete a worksheet to ensure basic understanding before moving on to the lab activity.

Students will practice measuring mass using a triple beam balance and an electric balance. Students will be asked to find the mass of different solid objects as well as liquids, using both types of balances. Students will be assessed on their accuracy & will participate in class discussion on the lab. **Lesson extension for enrichment: extra mystery to solve using the balances, all students will complete the basic lab**

Prior Knowledge Check: Without any discussion or background information, students will fill out a chart trying to define some key terms in this unit. (solar system, galaxy, star, moon, planet, universe) They will work with their table and then share their answers with the class in a class discussion. Corrections will be made, and the correct definitions will be discussed and filled in.

Activity - Virtual Space Exploration - Students will view VR videos and answer questions to simulate what it's

like to be an astronaut and see what their day-to-day is like.

Demonstration – Students will first brainstorm with their table to come up with the explanation for day and night. Share answers with the class.

Demonstration #1 - using a lamp and a ball as the Earth, the ball will be spun and moved to show day and night

Demonstration #2 - using a lamp for the sun, students make a circle around the lamp and spin according to the time of day, assuming they are the Earth (midnight, noon, dawn, dusk)

Notes/Discussion - Take notes on Earth's rotation and the cause of day and night

Demonstration – Students will first brainstorm with their table to come up with the explanation for seasons. Share answers with the class.

Demonstration - using a lamp and a big beach ball as the Earth (labeled hemispheres) the ball will be moved and tilted to show seasons

Assign a practice worksheet to reinforce concepts. *(most likely homework)*

Notes/Discussion - Take notes on Earth's revolution and the cause of the seasons

notes copied & given to students as needed

Discussion/Venn Diagram: Students will fill out a Venn Diagram on their own, comparing and contrasting rotation vs. revolution. Class discussion will follow, and the students' answers will be put on the board. A review demonstration involving the students will follow.

Demonstration/Notes/Discussion/Diagram –

Demonstration - using a lamp as the sun, a globe as the Earth, and a small ball as the moon; the moon & Earth will be moved to show the shadows from the sun and the reason for the phases of the moon.

-Students will draw and label a phases of the moon diagram. Students will take notes & discuss why we see different phases. Assign a practice worksheet to reinforce concepts. *(most likely homework)*

*notes copied & given to students as needed**peer check with table for all learners, answers on board for student support**

Eclipse Demonstration – Lamp as sun, globe as Earth & ball as moon. The Earth and moon will be moved around the sun to show how/when shadows are cast on the Earth to create a solar eclipse and shadows are cast on the moon to create a lunar eclipse. Assign a practice worksheet to reinforce concepts. *(most likely homework)*

Tide Demonstration – students will act as the moon and Earth, and a string will represent the movement of Earth's water according to the moon's gravity

Notes/Discussion - Take notes on Solar and Lunar Eclipses and tides

notes copied & given to students as needed

Planet Research Presentation – Students will work in groups of 3 and research one of the 8 planets in our solar system. They will create a Google Slides presentation with all of the information they researched, according to

their rubric. They will present their research to the class. Each individual student will write a paragraph summarizing what he or she has learned about their planet.

Stations Activity – Students will rotate through 6 stations reviewing the solar system. Station 1: Quizlet, Station 2: Heads Up #1, Station 3: Tic Tac Toe, Station 4: Matching, Station 5: Heads Up #2, Station 6: Quizizz

All lab activities will review lab safety before beginning the activity

Assessments

Science courses are designed to promote skill attainment. Student progression and pace through which they proceed through the performance tasks is based on their affinity for and ability to reach skill attainment. The teacher will determine formative and summative skill attainment; alternative assessments will be incorporated for each student based on their strengths and challenges.

Formative Assessments:

- Worksheets/Practice Problems
- Do Nows
- Exit Tickets
- Class Discussions
- scientific method quiz
- metric conversion quiz
- graphing quiz
- Solar vs Lunar Eclipse quiz
- Phases of the Moon quiz

Summative:

Unit Tests:

- Scientific Method
- Metric
- Space

Bench Marks:

Formal Lab Reports

- Tennis Ball Lab
- Paper Plane Lab
- Calcium Chloride Lab
- Bean Lab

Alternative:

- Observation vs Inference Short Story
- Planet Research Project

- Length Lab
- Mass Lab
- Volume Lab
- Check for Understandings

Materials

Elevate Science Textbook and online textbook

Guided note packets (teacher-developed)

Technology (student & teacher laptops, SmartBoard, document camera)

Google slides

Worksheets/notes

YouTube/Netflix

Virtual Activities - Gizmo, EdPuzzle, Khan Academy

Safety Equipment

Lab goggles

Graduated cylinders varying in mL

Meter stick

electronic balance

triple-beam balance

ruler

food coloring

Calcium chloride

test tubes

thermometer

tennis balls

toothpicks

plastic cups

pinto beans

plastic bags

duct tape

paper towels

beakers

Standards

MATH.6.RP	Ratios and Proportional Relationships
MATH.K-12.1	Make sense of problems and persevere in solving them
ELA.L.SS.6.1	Demonstrate command of the system and structure of the English language when writing or speaking.
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.3	Construct viable arguments and critique the reasoning of others
MATH.K-12.5	Use appropriate tools strategically
ELA.L.KL.6.2	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
MATH.K-12.7	Look for and make use of structure
MATH.K-12.8	Look for and express regularity in repeated reasoning
ELA.W	Writing
SCI.MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. Examples of models can be physical, graphical, or conceptual.
SCI.MS.ESS1.A	The Universe and Its Stars Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.
SCI.MS.ESS1.B	Earth and the Solar System This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. Patterns can be used to identify cause-and-effect relationships.
SCI.MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state). Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and

	revising models to describe, test, and predict more abstract phenomena and design systems.
SCI.MS.ESS1.A	The Universe and Its Stars
	Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.
SCI.MS.ESS1.B	Earth and the Solar System
	The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.
	The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.
SCI.MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system.
	Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
SCI.MS.ESS1.B	Earth and the Solar System
WRK.9.2.8.CAP.12	Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.
TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.IML.2	Represent data in a visual format to tell a story about the data (e.g., 2.MD.D.10).
	Computer models can be used to simulate events, examine theories and inferences, or make predictions.

Strategies for Modifications

See attached document

https://docs.google.com/spreadsheets/d/1wZeK2sYMgTDgqPB3B9-_tnn4GVTjdlgfbgsWmnSKX2E/edit?usp=sharing