3B: Beyond the Solar System

Content Area: **Science**
Course(s):
Time Period: **December**
Length: **3 Weeks**
Status: **Published**

Unit Overview

Billions and billions of stars, along with gas and dust, form our galaxy, commonly called the Milky Way. Ours is a flattened spiral galaxy, one of several types that characterize the universe's countless galaxies. In this concept, you will learn about the different types of galaxies.

Enduring Understandings

Lesson Objectives

By the end of the lesson, students should be able to:

1. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
2. Calculate the time required for space travel to understand the vast distances to objects in space.
3. Map distances between celestial objects at a meaningful scale.
4. Model how mass and distance influence the gravitational attraction between stars.
5. Design models of how galaxies interact, applying the patterns of gravity to a new scale of objects.

Essential Questions

- **Overarching Question**
    - What is the universe, and what is Earth's place in it?
- **Focus Question**
    - What is the universe, and what goes on in stars?
- **Lesson Questions**
    - How are stars distributed in space?
    - Where is our solar system located?
    - How are galaxies classified?

- **Can You Explain?**
    - How can you compare and contrast different types of galaxies?

Instructional Strategies & Learning Activities

Allow approximately 100 minutes to complete this lesson.

- Observing Phenomena [15 min]: Students consider how difficult it would be to fit a scale model of our Milky Way Galaxy in the classroom.

  Suggested Reading: Introduction and Section 1

- Investigation 1: The Distance Between Celestial Bodies [30 min] Students use maps of locations on Earth to model the scale of distance between celestial bodies.

  Suggested Reading: Sections 2–4

- Investigation 2: Mass, Distance, and Gravity in the Universe [40 min] Students model how gravity between stars depends on mass and distance by using their bodies.

  Suggested Reading: Sections 5–6

- Making Sense of Phenomena [15 min]: Students explain why it is difficult to fit a scale model of our Milky Way Galaxy in a classroom.

  Suggested Reading: Lesson Summary

Integration of Career Exploration, Life Literacies and Key Skills

	An individual's strengths, lifestyle goals, choices, and interests affect employment and income.
	Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.
	Multiple solutions often exist to solve a problem.
9.4.8.DC.8	Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).
	Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.
CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.

CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technolgy and Design Integration

Discovery Tech book incorporates using technology to explore.

Interdisciplinary Connections

LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.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.
LA.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.
LA.RST.6-8.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
LA.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
LA.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.
LA.WHST.6-8.1	Write arguments focused on discipline-specific content.
LA.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.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.

LA.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.
LA.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
LA.WHST.6-8.10	Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Differentiation

Struggling Students

1. Remind students that light-years are units of distance rather than time. Have them calculate the distance from the sun to Earth using light-years (0.00001581 light years). Then do the calculation the other way using km (149.6 million km).
2. Provide students with a diagram of our galaxy on the board for reference throughout the lesson. Indicate the location of Earth on the diagram.

ELL

1. Assist students in identifying familiar prefixes and/or words within words for each glossary term (e.g. *nebula* is a Latin word meaning "vapor, clouds, mist, or fog").
2. Encourage students to demonstrate their understanding by drawing concepts. For example, they can create their own diagrams of the different types of galaxies, carefully labelling each one.

Accelerated Students

1. Challenge students with the following problem: Earth is estimated to be about 27,000 light-years from the center of the Milky Way galaxy. If our fastest passenger airplanes travel at about 1600 km/hour (about 1000 miles/hour), how long would it take to travel from Earth to the center of our galaxy at that speed? The answer will likely surprise students and will give them a better idea of how large our galaxy actually is.
2. The Milky Way is part of the Local Group. Assign students to research the Local Group and find out how many galaxies it contains, what kind of galaxies these are, which galaxies are nearest to ours, and the extent in space of this group. Ask them to also research the Virgo Cluster of which the Local Group is a part, and perhaps the Virgo Supercluster as well.
3. Ask students to research the Andromeda galaxy. Instruct them to find out what kind of galaxy it is, how large it is, and how far away it is from the Milky Way. Have them create a Venn diagram comparing the Andromeda galaxy with the Milky Way.

Differentiation in science can be accomplished in several ways. Once you have given a pre-test to students, you know what information has already been mastered and what they still need to work on. Next, you design

activities, discussions, lectures, and so on to teach information to students. The best way is to have two or three groups of students divided by ability level.

While you are instructing one group, the other groups are working on activities to further their knowledge of the concepts. For example, while you are helping one group learn the planet names in order, another group is researching climate, size, and distance from the moon of each planet. Then the groups switch, and you instruct the second group on another objective from the space unit. The first group practices writing the order of the planets and drawing a diagram of them.

Here are some ideas for the classroom when you are using differentiation in science:

- Create a tic-tac-toe board that lists different activities at different ability levels. When students aren't involved in direct instruction with you, they can work on activities from their tic-tac-toe board. These boards have nine squares, like a tic-tac-toe board; and each square lists an activity that corresponds with the science unit. For example, one solar system activity for advanced science students might be to create a power point presentation about eclipses. For beginning students, an activity might be to make a poster for one of the planets and include important data such as size, order from the sun, whether it has moons, and so on.

- Find websites on the current science unit that students can explore on their own.

- Allow students to work in small groups to create a project throughout the entire unit. For example, one group might create a solar system model to scale. Another group might write a play about the solar system. This is an activity these groups can work on while they are not working directly with you.

Differentiation in science gets students excited to learn because it challenges them to expand their knowledge and skills, instead of teaching the whole group concepts they have already mastered.

Modifications & Accommodations

Refer to QSAC EXCEL SMALL SPED ACCOMMOCATIONS spreadsheet in this discipline.

Modifications and Accommodations used in this unit:

IEP and 504 Accommodations will be utilized.

In addition to differentiated instruction, IEP's and 504 accommocations will be utilized.

Benchmark Assessments

Benchmark Assessments are given periodically (e.g., at the end of every quarter or as frequently as once per

month) throughout a school year to establish baseline achievement data and measure progress toward a standard or set of academic standards and goals.

Schoolwide Benchmark assessments:

Aimsweb benchmarks 3X a year

Linkit Benchmarks 3X a year

Additional Benchmarks used in this unit:

Formative Assessments

Assessment allows both instructor and student to monitor progress towards achieving learning objectives, and can be approached in a variety of ways. **Formative assessment** refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. It includes effective tools for helping to shape learning, and can even bolster students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks (Trumbull and Lash, 2013). It can include students assessing themselves, peers, or even the instructor, through writing, quizzes, conversation, and more. In short, formative assessment occurs throughout a class or course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs (Theal and Franklin, 2010, p. 151).

Formative Assessments used in this unit:

See assessments located in the unit link above.

Projects:

-Modeling the Milky Way poster

-Classifying Galaxies poster project

Summative Assessments

Summative assessments evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (though they do not need to be). Summative assessment can be used to great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches.

Summative assessments for this unit:

See assessments located in the unit link above.

Instructional Materials

See materials located in Unit above.

Standards

MS-ESS1	Earth's Place in the Universe
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). Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth. 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. Develop and use a model to describe phenomena.
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.
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. Systems and System Models Models can be used to represent systems and their interactions.