

**Full STEAM Ahead:  
Connecting Library of Congress Primary Sources and Graphic Novels**

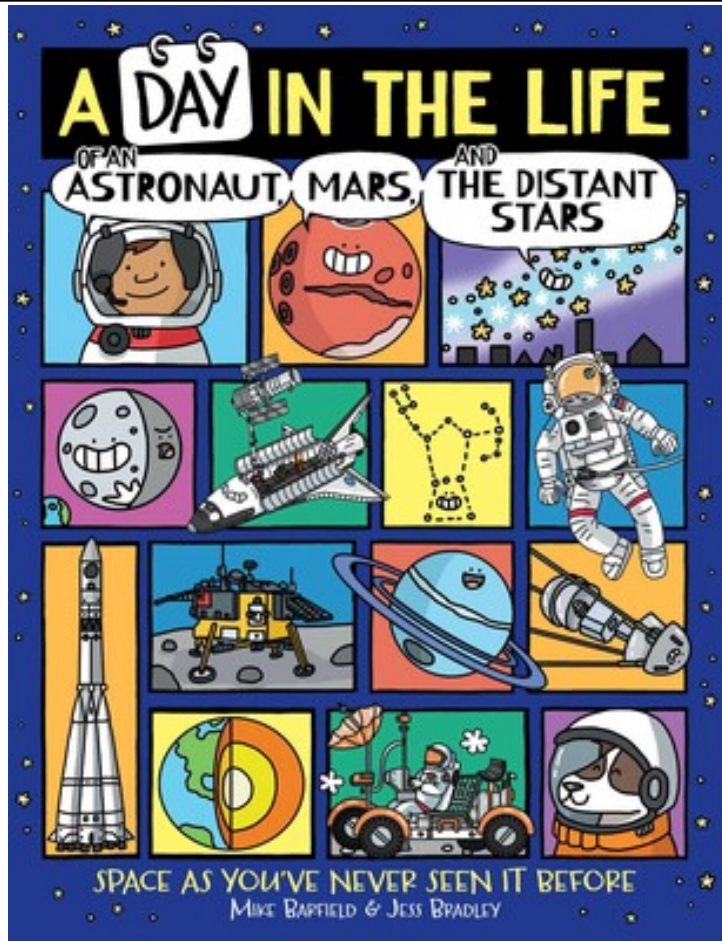
**Lesson Plan Template**

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**Grade Level(s):** Grade 8

**Subject:** Science

**Length of Class:** 50 minute class x 4-9 days, depending on use of cross curricular activities and extensions



**Image Citation:** A day in the life of an astronaut, Mars, and the distant stars [Image of book cover]. (2023). Simon & Schuster.  
<https://www.simonandschuster.com/books/A-Day-in-the-Life-of-an-Astronaut-Mars-and-the-Distant-Stars/Mike-Barfield/9781534489219>

<b>Lesson Title:</b>	Solar System Odyssey: Discovering Planets, Moons, and Beyond
<b>Overview:</b>	Students will read the graphic novel <i>A Day in the Life of an Astronaut, Mars, and the Distant Stars</i> , by Mike Barfield and Jess Bradley, explore primary sources to compare properties of the planets, and create a scale model of the solar system. Students may also present their research about planets or other solar system objects to the class.
<b>Learning Objective:</b>	<ul style="list-style-type: none"> <li>• Students will analyze and explore primary sources to build a deeper understanding of the formation and contents of our solar system.</li> <li>• Students will analyze and explore primary sources to build a deeper understanding of the use of technologies in exploring our solar system.</li> </ul>
<b>Standards:</b>	<p><b><u>Science</u></b>  8-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.  8-ESS1-3. Evaluate information to determine scale properties of objects in the solar system.  Constructing Explanations and Designing Solutions.</p> <ul style="list-style-type: none"> <li>• Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) 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.</li> <li>• Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.</li> </ul> <p><b><u>Social Studies</u></b>  8th Grade Standard 5: Demonstrate an understanding of the impact of world events on South Carolina and the United States from 1929 to present.</p> <p><b><u>National School Library Standards</u></b>  AASL I.B.1: Inquire: Investigating questions.  AASL V.A.2: Reflecting and questioning assumptions and possible misconceptions.  AASL V.B.2: Providing opportunities for tinkering and making.</p>
<b>Essential Question:</b>	How is the solar system organized?
<b>Supporting Question(s):</b>	<ul style="list-style-type: none"> <li>• How is the composition of the inner planets different from the outer planets?</li> <li>• How does the composition of the planets affect their placement in the solar system? What role does gravity play in our solar system?</li> </ul>

**Digital Primary and Secondary Sources:**

- Article: Library of Congress Collection: *Finding Our Place in the Cosmos: From Galileo to Sagan and Beyond* section entitled *The Cosmos: Its Structure and Historical Models*

Images: Series of historical charts or maps to compare with present day map of the Solar System and photographs from telescopes:

- Colby, H. & Jones & Newman. (1846) *A plan or map of the Solar System projected for schools & academies*. [Rochester, N.Y.: Publisher not identified, . New York: Lith. of E. Jones & G.W. Newman] [Map] Retrieved from the Library of Congress, <https://www.loc.gov/item/2013593145/>.
- Bowen, E. (1747) *The Solar System, with the orbits of 5 remarkable comets*. London: Emanuel Bowen. [Map] Retrieved from the Library of Congress, <https://www.loc.gov/item/2013593161/>.
- Fer, N. D. (1669) *Three maps of the cosmological systems of Ptolemy, Copernicus, and Brahe*. A Paris: Chez A. De Fer, to 1670. [Map] Retrieved from the Library of Congress, <https://www.loc.gov/item/2013593142/>.
- Ferguson, J. (1769) *Collection of Nine Images Including Astronomical Instruments, Celestial Charts, and a World Map*. [No Earlier Than] [Map] Retrieved from the Library of Congress, <https://www.loc.gov/item/2013593153/>.
- Burges, B. & Norman, J. (1789) *The Solar System Displayed*. Boston: J. Norman & c. [Map] Retrieved from the Library of Congress, <https://www.loc.gov/item/2013593138/>.

Article: Smithsonian Air and Space Museum collection: *How Did We Discover the Planets?* [Editorial overview]:

<https://airandspace.si.edu/stories/editorial/how-did-we-discover-planets>

Article: *Exploring the Universe in our Collections*: [Summary of discoveries enabled by increasingly complex technology]:

<https://airandspace.si.edu/stories/editorial/exploring-universe-our-collections>

Images: Historical technology used to explore the solar system:

- Spectrograph, Prime Focus. (~1940-1973). [Image]. Scientific instrument. California Institute of Technology. [https://airandspace.si.edu/collection-objects/spectrograph-prime-focus/nasm\\_A19980105000](https://airandspace.si.edu/collection-objects/spectrograph-prime-focus/nasm_A19980105000)
- Smithsonian Institution (2023). *Galilean telescope (Replica)*. Retrieved from National Museum of American History, Smithsonian Institution, <https://airandspace.si.edu/multimedia-gallery/nmah-nmah2001-01232jpg>

	<ul style="list-style-type: none"> <li>● Smithsonian Institution (2017). <i>Wide Field Planetary Camera II (WFPC 2) Hubble, Flown</i>. Retrieved from National Museum of American History, Smithsonian Institution, <a href="https://airandspace.si.edu/collection-objects/wide-field-planetary-camera-ii-wfpc-2-hubble-flown/nasm_A20140124000">https://airandspace.si.edu/collection-objects/wide-field-planetary-camera-ii-wfpc-2-hubble-flown/nasm_A20140124000</a></li> <li>● Smithsonian Institution (1972). [Four images] <i>Model, Radio Telescope, Solar</i>, Retrieved from National Museum of American History, Smithsonian Institution, <a href="https://airandspace.si.edu/collection-objects/model-radio-telescope-solar/nasm_A19751494000">https://airandspace.si.edu/collection-objects/model-radio-telescope-solar/nasm_A19751494000</a></li> </ul> <p>Article: <i>4 Ways We Have Explored Our Planets</i>  <a href="https://airandspace.si.edu/stories/editorial/4-ways-we-have-explored-our-planets">https://airandspace.si.edu/stories/editorial/4-ways-we-have-explored-our-planets</a></p>
<b>Required Classroom Materials:</b>	<ul style="list-style-type: none"> <li>● Class set of <i>A Day in the Life of an Astronaut, Mars, and the Distant Stars</i> by Barfield, Mike; Illustrated by Bradley, Jess</li> <li>● Directions to building the model - <a href="#">Scale Model of the Solar System (ESS1-3).pdf</a> <ul style="list-style-type: none"> <li>○ 3 meters of receipt tape (or toilet paper) per class</li> <li>○ construction paper and/or bulletin board paper</li> <li>○ markers or colored pencils</li> <li>○ scissors - class set</li> <li>○ rulers and meter sticks - class set</li> <li>○ glue per class</li> <li>○ compass - class set</li> <li>○ index cards - 3 per group</li> </ul> </li> <li>● <a href="#">Student Research Sheet</a></li> <li>● Similar version of model activity - <a href="#">Student Project: Make a Scale Solar System   NASA/JPL Edu</a></li> <li>● Timeline Activity: Set of printed and laminated copies of the historic charts (cited above) <ul style="list-style-type: none"> <li>○ Paper timeline or drawn on white board.</li> <li>○ Markers</li> <li>○ Glue or tape</li> </ul> </li> <li>● <a href="#">Teacher's Guide for Analyzing Primary Sources</a> to guide students through the <a href="#">Primary Source Analysis Tool</a> worksheet for students</li> <li>● Periodic Table</li> <li>● Kit to show mass/ weight including scale</li> </ul>
<b>Classroom Environment:</b>	<ul style="list-style-type: none"> <li>● Large science lab tables arranged in rows with an unobstructed view of ClearTouch Panel (touchscreen board) for group instruction and/or group presentations (see Differentiation and Adaptations).</li> </ul>

	<ul style="list-style-type: none"> <li>• Class set of <u><i>A Day in the Life of an Astronaut, Mars, and the Distant Stars</i></u>, as well as other research resources, should be made available to students.</li> <li>• During research and construction of the model, lab tables may be arranged in a way to facilitate group work.</li> </ul>
<b>Differentiation and Adaptations:</b>	<ul style="list-style-type: none"> <li>• Pre-load vocabulary list and post in view of class.</li> <li>• Display/Construct a large timeline and have students place pertinent events in order.</li> <li>• Remind students about the differences in weight, mass, and density with a chart or objects.</li> <li>• A presentation of research may be included as part of the construction of the solar system model, in which students present what they have discovered about the composition of planets and other solar system objects and how the composition contributed to their size and position in the solar system.</li> <li>• Students may also be asked to calculate the scale position and sizes of planets/solar system objects (scale is included in Classroom Materials list above but can be removed).</li> </ul>

<b>Lesson Sequence/Procedures</b>	
<b>Estimated Time Needed</b>	<b>Detailed Description of Teaching and Learning</b>
1 class period	<ul style="list-style-type: none"> <li>• Introduce topic and read <u><i>A Day in the Life of an Astronaut, Mars, and the Distant Stars</i></u>.</li> </ul>
1 class period <i>(if collaborating with Social Studies)</i>	<ul style="list-style-type: none"> <li>• Set up basic timeline. Briefly give a timeline of historical exploration and theories using primary source images of historic charts and maps.</li> </ul>
1 class period <i>(if collaborating with Social Studies)</i>	<ul style="list-style-type: none"> <li>• Compare the historical charts to each other chronologically. Did their theories change? How did these scientists draw their conclusions? Were their theories based on observation? How did technology help scientists? How did technology cause conflicting theories?</li> </ul>
1 class period <i>(if collaborating with Social Studies)</i>	<ul style="list-style-type: none"> <li>• Compare what you learned from the historic charts to a modern chart of the solar system. Are there similarities? What has changed?</li> <li>• Examine images of historic astronomical tools to modern technology?</li> </ul>
1-2 class periods	<ul style="list-style-type: none"> <li>• Students use resources to research composition and size of planets/solar system objects assigned to their group.</li> <li>• (optional) Students calculate scale size and position of planets/solar system objects.</li> <li>• Students construct a 2-D model of planets/solar system objects assigned to their group.</li> <li>• Students write at least 3 important facts for each planet/solar system object assigned to their group. This should include information about composition, size, and distance from Sun.</li> </ul>
1-2 class periods	<ul style="list-style-type: none"> <li>• Groups present their research of planets/solar system objects.</li> </ul>

(optional extension/ differentiation)	
1 class period	<ul style="list-style-type: none"> <li>● Class constructs scale model of Solar System.</li> <li>● Class discussion of why some planets are located closer to the Sun than other planets.</li> </ul>

<b>Assessments:</b>	<ul style="list-style-type: none"> <li>● Use LoC <a href="#">Primary Source Analysis Tool</a> for assessment of comparing historical solar system maps.</li> <li>● Completed Scale Model of Solar System, with teacher feedback for each group on their contribution to the model</li> <li>● Placement of historic charts and technology on timeline</li> <li>● Formative assessments should occur with the timeline of historical exploration and theories</li> <li>● At the end of the Unit, a summative assessment will be given.</li> </ul>
<b>Learning Extensions:</b>	<p>Ideas for extending the lesson or connecting to other curricular topics or lessons:</p> <ul style="list-style-type: none"> <li>● A Historical Explorations of Space activity has been included as a possible cross-curricular project with Social Studies.</li> <li>● Connect content with other graphic novels, biographies, narrative nonfiction, historical fiction, and motion pictures to topics pertaining to Hispanic history, women’s history, Black history, and space exploration. Examples may include, but are not limited to: <ul style="list-style-type: none"> <li>○ Fiction: <ul style="list-style-type: none"> <li>■ Emerson, K. (2017). <i>Last day on Mars</i>. Walden Pond Press: NYC, NY.</li> <li>■ Holm, J. (2022). <i>The lion of Mars</i>. Yearling: NYC, NY.</li> <li>■ Kerley, B. (2007). <i>Greetings from planet Earth</i>. Scholastic: NYC, NY.</li> </ul> </li> <li>○ Graphic novels: <ul style="list-style-type: none"> <li>■ Ottavianni, J. &amp; Wicks, M. (2020). <i>Astronauts: Women on the final frontier</i>. First Second: NYC, NY.</li> <li>■ Brown, D. (2019). <i>Rocket to the moon! Series: Big ideas that changed the world ; #1</i>. Amulet: NYC, NY.</li> <li>■ Adamson, T.K., Purcell, G. &amp; Beatty, T. (2007). <i>The first moon landing</i>. Capstone: Mankato, MN.</li> </ul> </li> <li>○ Nonfiction: <ul style="list-style-type: none"> <li>■ Stern, A. &amp; Grinspoon, D. (2019). <i>Chasing new horizons : inside the epic first mission to Pluto</i>. Picador: NYC, NY.</li> <li>■ Felix, R. (2015). <i>12 things to know about space exploration</i>. Capstone: Mankato, MN.</li> <li>■ Chaikin, A. &amp; Bean, A. (2009). <i>Mission control, This is Apollo : The story of the first voyages to the moon</i>. Viking: NYC, NY.</li> </ul> </li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>■ Stone, T. L. (2009). <i>Almost astronauts: 13 women who dared to dream</i>. Candlewick Press: Somerville, MA.</li> <li>■ Shetterly, M. L. (2016). <i>Hidden figures : the untold true story of four African-American women who helped launch our nation into space, Young readers edition</i>. Harper: NYC, NY.</li> <li>■ Sparrow, G., John, J. &amp; McNab, C. (2016). <i>Exploring space</i>. Cavendish Square: NYC, NY.</li> <li>○ Motion Picture/Video: <ul style="list-style-type: none"> <li>■ Melfi, T. (2016). Hidden Figures [Motion Picture].</li> <li>■ Nye, B. (Writer) &amp; Gross, M. (Director). (1996). Space exploration, <i>Bill Nye the science guy</i>. KCTS Seattle, McKenna/Gottlieb Producers, Inc., Rabbit Ears Productions ; Buena Vista Television ; Buena Vista International.</li> </ul> </li> <li>○ Biography: <ul style="list-style-type: none"> <li>■ Multiple volumes which include: Mae Carol Jemison, Alan Shepard, John Glenn, Ellen Ochoa, et al.</li> </ul> </li> </ul>
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