

**Middle School STEM Science Lab/Activity Planner**

<u>Name of Lab/Activity:</u> AU vs LY	<u>Grade:</u> 8
<u>California Science Standard(s):</u> (please copy and paste standards taught during this lesson)	
4.c Students will know how to use astronomical units and lights years as measures of distance  <b>From the framework:</b> Distances between astronomical objects are enormous. Astronomers use the Astronomical Unit (AU) which is equal to the average distance from Earth to the sun: $1 \text{ AU} = 1.496 \times 10^{11}$ meters Astronomers also use light years. A light year is equal to $1 \text{ LY} = 9.462 \times 10^{15}$ meters	
<u>Learning Objective/Goal:</u> <ul style="list-style-type: none"> <li>• Astronomical unit (AU) measures distances within solar system based on the Earth-Sun distance as 1 AU</li> <li>• Light year (LY) measures distances between stars – not time.</li> <li>• Use scientific notation to compare relative distances within solar system using millions of miles</li> </ul>	
<u>Language Objective/Goal:</u> (based on California Common Core Standards)	
Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression  Practice citation of images using URL and MLA format	
<u>Materials &amp; Resources:</u>	
“Powers of Ten” video showing scientific notation and distance calculators Whiteboards computer (at least 1) MLA format sheet	
<u>Procedure:</u>	<u>Teaching Notes:</u> (include timing)
1. “Powers of Ten” video 2. Class discussion  3. Convert distance in (millions of miles) to (miles)  4. Convert distance (miles) to scientific notation  5. Use a formula to convert distances from millions of miles into AU  6. Record steps#3-5 in table	Teacher Tube: <a href="http://www.teachertube.com/viewVideo.php?video_id=119236">http://www.teachertube.com/viewVideo.php?video_id=119236</a>  For steps #3-13: work in small groups  Steps #3 & 5: use whiteboard first , then transfer to worksheet  See attached table

<p>7. Discuss 8. Quickwrite</p> <p>9. Make 2 cards per planet.</p> <p>10. Card Sort Challenge</p> <p>11. Check answers</p> <p>12. Discuss 13. Quickwrite</p>	<p><b>Prompt: If miles was kilometers, how would the number change? Prompt: Use ratio and proportion to explain how the formula and the website converter generate the same answer for the same distance.</b></p> <p>Instructions: Both cards have the same title, “Distance from Sun” Card set 1: astronomical units (AU) Card set 2: millions of miles using scientific notation</p> <p><b>Rank planets by distance from sun using both sets of cards</b> <i>Hint: You may not use your model of the solar system (see prior lesson, below)</i></p> <p><i>Now use your model of the solar system (see prior lesson, below)</i></p> <p><b>Prompt: Which distance was best to use for ranking – astronomical units or scientific notation in miles? Justify your choice.</b></p>
<p><u>Math Connection:</u></p> <p>Powers of 10/scientific notation</p> <p>Cross-checking answers using multiple methods</p>	<p><u>Teaching Notes:</u></p> <p>Refer students to science or math text</p>
<p><u>Technology Extension of Learning:</u></p> <p>Cross-checking answers using website: <a href="http://webmath.com/sn_convert.html">webmath.com/sn_convert.html</a></p> <p>online nasa archives</p> <p><a href="http://www.easybib.com/">http://www.easybib.com/</a></p>	<p><u>Teaching Notes:</u></p> <p>Conversion calculator connects answers to written explanations for students to model</p> <p>Students choose Images of solar system objects to add to their scale model of distances</p> <p>MLA Bibliography generator</p>

<p><u>Formative Assessment:</u> (attach)</p> <p>#1 “Card Sort Challenge”</p> <p>#2 “Astronomical Units” Read &amp; Respond to prompts</p>	<p><u>Teaching Notes:</u></p> <p>Student-created as described in teacher notes above</p> <p>Students write, draw, convert to scientific notation</p>
<p><u>Strategies for EL and Special Needs Students:</u></p> <p>Calculations: Whiteboards</p> <p>Quickwrite Preparation: Sentence Frames</p> <ul style="list-style-type: none"> <li>• Pair/Share</li> <li>• Small Group</li> <li>• Whole group</li> </ul> <p>Formative assessment preparation:</p> <ul style="list-style-type: none"> <li>• Highlight/Annotate Reading</li> <li>• Read 3 Times: Tchr, Std #1, Std #2</li> <li>• Small group discussion</li> </ul>	<p><u>Vocabulary:</u></p> <p>Ratio, Proportion, Fraction</p> <p>Astronomical unit, light year, scientific notation</p>
<p><u>Alignment in science unit:</u> (Brief description of lessons taught <b>prior</b> this lab/activity):</p> <p><b>Create a scale model of the solar system, marking the position from the sun of each planet, dwarf planets, asteroid belt, heliopause (farthest point the sun throws its particles). Some suggestions:</b></p> <ol style="list-style-type: none"> <li>1. Adding machine tape “Pocket Solar System” <a href="http://www.astro.ucla.edu/~outreach/PocketSolarSystem.pdf">http://www.astro.ucla.edu/~outreach/PocketSolarSystem.pdf</a></li> <li>2. “Solar System on a String” <a href="http://www.jpl.nasa.gov/education/index.cfm?page=101">http://www.jpl.nasa.gov/education/index.cfm?page=101</a></li> <li>3. “Schoolyard Solar System” <a href="http://nssdc.gsfc.nasa.gov/planetary/education/schoolyard_ss/">http://nssdc.gsfc.nasa.gov/planetary/education/schoolyard_ss/</a></li> </ol>	
<p><u>Brief description of lessons taught <b>after</b> this lab/activity:</u></p> <ul style="list-style-type: none"> <li>• Webquest: Add images to solar system model. Cite image source in MLA format: text, book, URL</li> <li>• WebQuest Writing Prompt: What is the diameter of the solar system? (Voyager, Pluto)</li> <li>• WebQuest: What is gravity’s role in solar system formation? How well does accretion theory predict the content and structure of our solar system?</li> <li>• Writing Prompt: Answer 1 question. Provide evidence from the text, class notes, web research.             <ul style="list-style-type: none"> <li>○ Is it necessary to agree on one right answer during a discussion?</li> <li>○ When do scientists know there is nothing more to learn?</li> <li>○ How do scientists deal with uncertainty and accuracy?</li> <li>○ When is it OK for a scientist to say, “I don’t know?”</li> </ul> </li> </ul>	
<p><u>Lab/Activity adapted from:</u></p>	<p><u>Formative Assessment adapted from:</u></p>

<p><b>TeacherVision.com</b>  <a href="http://www.teachervision.fen.com/solar-system/printable/3744.html">http://www.teachervision.fen.com/solar-system/printable/3744.html</a></p> <p><b>“Bringing the Solar System Down to Earth Worksheet, Part B”</b></p>	<ul style="list-style-type: none"> <li>• Created by Hope Oliver</li> </ul>
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<p><u>This lesson was developed by:</u></p>	
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