Lesson Plan

I. Cover Page
   • with illustration, Grade Level, Title of Lesson
   • Professional Watermark Information
   • your name, full name of team members, instructor, course, date

II. Lesson Plan – for yourself and other teachers
   • Professional Header
   • Title
   • Body
     i. Time
     ii. Vocabulary
     iii. Concepts to be learned
        1. Broad
        2. specific
     iv. Materials List
     v. Safety recommendation
   • Standards met through the lesson
     i. Use common core
     ii. Use Arkansas Frameworks for k-8 and Physical Science in High School
   • Background – basic information that the teacher will need to understand for teaching the lesson
   • Preparation
     i. Time required
     ii. Set up for teaching the lesson
     iii. Set up time for materials
   • Procedure
     i. How the lesson is presented – method
     ii. Give examples if there are calculations
     iii. Possible demonstrations or prompts
   • Reflection
     i. Teacher led Socratic questioning and discussion
     ii. Ask questions which lead the student to make connections
     iii. Prompt the students to reflect on the lesson through questions and written responses
   • Assessment
     i. Formative assessment strategies here – provide examples of how to conduct this type of assessment

III. Activity Sheet(s) – same professional header and footer as lesson plan
   • Activity worksheets
     i. Tables, charts, etc.
     ii. All worksheets needed for recording information for the activity
     iii. Prompts for assessing their learning experience
     iv. Reflection questions at the end
   • Activity Lesson Sheet
     i. Introduction to the activity
     ii. Vocabulary students will need to know
     iii. List of materials for the lesson or experiment
     iv. Methods section – Detailed Instructions of how to perform the activity or experiment

C. Dianne Phillips, Associate Professor, EMPACTS Program Facilitator
Division of Science and Mathematics
Northwest Arkansas Community College, Bentonville, AR
Exploration 4: Solar System Distances

Time: 2 sessions, 45 minutes each

Key Vocabulary:
- Astronomical Unit (A.U.)
- Scale marker

Materials:
- For each group of 4 students:
  - model tape or disk
  - roll of adding machine paper at least 30 1/2" x 1" long
  - pens
  - colored pencils or crayons
  - scale to Solar System Distances Model directions
- For each student:
  - copy of Solar System Distances Calculations record sheet

Included in the kit:

Note:
In "Elementary Mathematics," Grade 9, Project 5.1, teacher's guide, the concepts taught in this lesson and other explorations. These Projects can be used to supplement and reinforce the science concepts being taught here.

National Standards:
- New planets of very different sizes, composition and surface features move around the sun in nearly circular orbits. Some planets have a variety of moons and even flat rings of rocks and ice particles

Overview:
Distances create a model of the solar system to scale, showing the relative distance between the planets.

Preparation:
Make copies of "Solar System Distances Calculations" and "Solar System Distances Model".

Cut strips of adding machine tape approximately 30 meters long for each group.

Procedure:
1. Review units of measurement and the importance of using the appropriate unit for the given task.
2. Ask students to estimate how long they think one meter is. Then estimate how far 100 meters is.
3. Explain to the class that they are going to build a scale model of the solar system. Review what the word scale means.
4. Introduce the concept of an Astronomical Unit. Using a scale of 1 A.U. = 1 meter, practice a few calculations as a group either on the board or on the overhead. Use the formula:
   \[ \text{A.U.} \times \text{1 meter} = \text{actual distance in meters on scale model} \]
   Remind students that there are 100 centimeters in a meter and that this will help make their calculations easier.

Do several examples so students have a clear understanding of the process.

Examples:
- 0.73 A.U. x 1 meter = 73.7 centimeters on the model
- 4.4 A.U. x 1 meter = 4 meters on the model
- 21.6 A.U. x 1 meter = 21.6 meters on the model

5. Hand out copies of the student worksheets. Have students work with a partner to do the calculations. Each student should have their own calculation page that can be attached to

Reflection:
Ask students, "What are some patterns you see in the distances of the planets from the sun?" What might explain these patterns?"

As the students identify the patterns write them on the board or a piece of chart paper, along with their explanations.

Assessment:
Ask students to create a scale for solar system model that might fit in a smaller area. In their science notebook they should show the formula and the measurements for each planet's location using the new scale. Students should explain why they chose the scale they did.

For example:
Formula: y A.U. x 5 meter = distance on model
Mercury: 5.5 A.U. x 5 meter = 27.5 meters
27.5 cm on the model
Lesson Plan

Grade 6/Astronomy

Solar System Distances
Calculations

For this activity, you are going to make a scale diagram of the distances from the sun for each planet. Use a scale of 1 A.U. = 1 meter. Calculate the number of meters you need to represent each distance given.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Distance from the Sun in Astronomical Units (AU)</th>
<th>Number of Meters Needed on the Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>0.39</td>
<td></td>
</tr>
<tr>
<td>Venus</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Earth</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Mars</td>
<td>1.52</td>
<td></td>
</tr>
<tr>
<td>Jupiter</td>
<td>5.21</td>
<td></td>
</tr>
<tr>
<td>Saturn</td>
<td>9.54</td>
<td></td>
</tr>
<tr>
<td>Uranus</td>
<td>19.19</td>
<td></td>
</tr>
<tr>
<td>Neptune</td>
<td>30.06</td>
<td></td>
</tr>
<tr>
<td>Pluto</td>
<td>39.50</td>
<td></td>
</tr>
</tbody>
</table>

Materials: adding machine tape, meter tape, pencil, colored pencils or crayons, calculations for distances.

Using the information from Solar System Distances – Calculations page, follow these steps to create your model:

1. Draw a dark line across the end of the roll of adding machine tape and label it "SUN".
2. Unroll the adding machine tape a little and measure from the "SUN" line the number of meters you have marked in the space off Solar System Distances – Calculations page for Mercury.
3. Draw an easily seen dot at that point and label it "MERCURY".
4. Continue to do this for each planet.

When you have finished, roll up your adding machine tape and secure your model with a rubber band or paper clip so that it can be easily handled. Roll so that the SUN is on the outside of the roll. Be sure the names of each member of your group is on the roll where it can be seen.