Scale Model of the Solar System

Summary

Students use adding machine tape to make a scale model of the solar system.

Time Frame

1 class periods of 45 minutes each

Group Size

Small Groups

Materials

- Conversion Worksheet (1 per student)
- Calculators (1 per student)
- 2 meter sticks (per group)
- 12 meters of adding machine tape (per group)
- Planet stickers or colored pencils to draw planets.
- A long open space (hallway, gym, etc.) for the final layout of the models.

Background for Teachers

Students have various misconceptions about the solar system. Some individuals believe that the Earth is the center of the solar system and that it is also the largest object in the solar system. Students may believe that the solar system is very full of objects, or they may believe that other objects seen in the solar system come from outside and are not a part of the solar system.

Without going into much detail, current theories suggest that the solar system was formed just under five billion years ago when a cloud of interstellar gas and dust (a nebula) with a very slight rotation began to collapse and condense. As it condensed, the nebula also contracted. As the condensation and contraction continued, the rotation caused the nebula to flatten until it became a disc with a concentration in the center, the primordial sun. Meanwhile, solid particles condensed toward the inner concentration and accumulated to form planets. The denser material formed the rocky inner planets and the lighter matter formed the outer gaseous planets. The pressure of the solar radiation and the solar wind blew the solar system clean of most of the remaining matter that did not go into the planets.

As it stands now, 99.85% of the mass of the solar system is in the sun, and the planets take up another 0.135% of the mass. Thus, 99.985% of the mass of the solar system is to be found in the sun and its planets. The remaining 0.015% is distributed among the natural satellites, comets, meteoroids, asteroids (minor planets), and the interstellar medium itself. Therefore, given the volume of the solar system and the obvious concentrations of mass, the overall solar system is very empty. Even though objects are drawn into the center of the solar system by the gravitational pull of the sun, it is highly unlikely that anything large will hit our planet (once in 100 plus years has recently been given as the time between occurrences of a noticeable collision; once in 100,000 plus years between very large collisions). As an example of the vast emptiness of the solar system, picture the Rose Bowl as the inner solar system and an orange on the fifty-yard line as the sun. The planets would be like sand grains on the playing field. The chance of something from outside the stadium hitting one of those sand grains is very slim.

Intended Learning Outcomes

- Given appropriate instrument, measure length.

Use math to communicate information.
Report using models.

Instructional Procedures

Briefly discuss the enormous size of the solar system. Explain that because the solar system is so large, we have to use models to study it. (You can't bring the actual solar system into your classroom.) Today the students will be constructing their own model of the solar system.
Distribute calculators and the Student Conversion Chart attached below. (Use the Teacher Conversion Chart attached below for your reference.)
Help students identify the conversion unit being used in this scale. Use calculators to fill in the distances of each of the planets on the chart.
Divide the students into groups and give each group two meter sticks and twelve meters of adding machine tape.
Instruct the students that they are to use their conversion chart to create a scale model of the solar system on the adding machine tape. At the location of each planet, they should place the corresponding sticker or draw the planet using their colored pencils.
IMPORTANT NOTE: Be sure to stress to the students that the planets will not be to scale. Although the distances between the planets are to scale, the stickers or drawings just mark the location of the planet. For a scale model of the planets, see the extension section.
Once the students have had time to create their models, have them display their work for one another to view.
Conclude by discussing what the students noticed or discovered while creating and viewing the scale models. Emphasize that most of the solar system is empty space. Help them identify the inner and outer planets. Discuss comets, meteoroids, and asteroids and use the model to demonstrate why the probability of the Earth being struck is extremely minor.

Extensions

Create a scale model of the planets using the Planet Conversion Chart attached below.

Assessment Plan

Use the Solar System Model Rubric below to assess student work.

Rubrics

Solar System Model Rubric

Bibliography

This lesson plan was adapted from Operational Physical Science, NSF grant #8751216 by Dr. Donald Kirwan.

Authors

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