Solar Rotation

Overview:

Students view actual images of sunspots on the sun's surface to learn about solar rotation. Students perform mathematical calculations to compare how fast the sun rotates with how fast Earth rotates.

Objectives:

The student will:

- determine the sun's rate of rotation by studying sunspots;
- conclude the sun rotates about every 27 days;
- identify the direction of solar rotation;
- calculate the rate of rotation of sunspots on the sun using mathematical equations;
- calculate the rate of rotation of Earth using mathematical equations; and
- compare the rate of solar rotation to the rate of Earth's rotation.

Materials:

- Calculators
- VISUAL AID: "Solar Images (Early February)"
- VISUAL AID: "Solar Images (Late February)"
- STUDENT WORKSHEET: "Solar Rotation"

Activity Procedure:

1. Show the visual aids of solar images taken every two days from early to late February. Point out the sunspots, which are circled on the visual aids. Ask students to note the location of this group of sunspots on both visual aids.
2. By observing the group of sunspots students can tell the sun is rotating. Ask students, "In which direction is the sun rotating?"
3. Using the information on the visual aids, determine how many days it takes for the sun to complete one rotation. The visual aids show the sunspots return to their starting location between 26 and 28 days. Generally, the sun takes 27 days to rotate.
4. Ask the class, "Did the circled group of sunspots appear to stay exactly the same?"

   (Answer: No, the sun's surface is not solid like Earth's surface. The sun's boiling surface is constantly changing.)

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Answers to Student Worksheet:

1. *A. sunspots*

2.

Measurement		*Sun (miles)*	*Earth (miles)*
A	*Diameter (at equator)*	*870,000*	*7,926*
B	*Circumference*	*2,731,800*	*24,888*
C	*Miles per day*	*101,178*	*24,888*
D	*Miles per hour*	*4,216*	*1,037*

Teacher's Note: *Galileo was one of the first people to use a telescope to examine the sun. In 1610, he observed what looked like dark clouds on the sun's surface. During Galileo's time, the heavens were thought to be perfect and therefore the sun should not have spots.*

Christopher Scheiner, who was an enemy of Galileo, argued that the dark spots were solar planets closely orbiting the sun. Galileo reasoned that because the sunspots changed shape, moved at irregular rates and sometimes disappeared, they could not be solar planets. In 1630, Christopher Scheiner published Rosa Ursine, *a document about sunspots, in which he agreed with Galileo's contention.*

Name:_____ **Student Worksheet**

Solar Rotation

1. Galileo used _____ to determine that the sun rotates. Today these are often used to predict the aurora.

   A. sunspots B. solar rays C. solar wind D. solar flares

2. Fill in the following table using the mathematical formulas below.

Measurement		Sun (miles)	Earth (miles)
A	Diameter (at equator)	870,000	7,926
B	Circumference		
C	Miles per day		
D	Miles per hour		

How fast does a sunspot travel?

A) The circumference of the sun is the distance around the sun at its equator. To find the circumference, use the formula:

_____ **x** 3.14 **=** _____
Diameter *Circumference*

B) To determine how many miles sunspots travel each day, divide the sun's circumference by the number of days it takes for the sun to rotate using the formula:

_____ **÷** 27 **=** _____
circumference *days* *miles per day*

C) To determine how many miles sunspots travel each hour use the formula:

_____ **÷** _____ **=** _____
miles per day *hours in a day* *miles per hour*

How fast does Earth travel?

A) The circumference of Earth is the distance around Earth at its equator or middle. To find the circumference, use the formula:

_____ **x** 3.14 **=** _____
Diameter *Circumference*

B) To determine how many miles a country like Ecuador, which is on Earth's equator, travels each day, divide Earth's circumference by the number of days it takes for Earth to rotate. Be careful: How many times does Earth rotate on its axis in a day?

_____ **÷** _____ **=** _____
circumference *days* *miles per day*

C) To determine how many miles Earth travels each hour use the formula:

_____ **÷** _____ **=** _____
miles per day *hours in a day* *miles per hour*

