

Counting Sunspots

Sunspots are magnetic storms on the Sun—these dark areas are a little cooler than the rest of the Sun’s atmosphere. They can be easily seen when the Sun’s image is projected onto a white surface, using a telescope or binoculars. (Warning—do not look through binoculars or a telescope directly at the Sun!)

Scientists have observed sunspots for centuries, and kept records of the numbers of sunspots seen in a month or a year. They have noticed a distinct pattern in the numbers of sunspots—called the Sunspot Cycle.

What You Need:

- Circular stickers
- Sunspot data
- Slips of paper, each with a year and the number of sunspots for that year
- Bowl for holding the “drawing” slips
- Large graph drawn on brown butcher paper with the:
 - x-axis marked in years from the first observation to the last
 - y-axis marked in 10’s of numbers of sunspots

What to Do:

- Have your child draw one slip from the bowl. Help them determine the year and the number of sunspots for that year from the slip.
- Gather enough stickers so that each sticker represents 10 sunspots (for example, if there were 81 sunspots that year, collect 8 stickers)
- Find the year on the bottom of the graph.
- Fill in the graph vertically for that year with the appropriate number of dots.
- Discuss whether you can see a pattern to the graph. Is too much data missing? If so, return to look at it again later in the day.

Parent Prompts:

Are there years with lots of sunspots? Are there years with very few sunspots?

Do you see a pattern to the numbers of sunspots increasing and decreasing? (It takes 11 years to go from low numbers to high numbers and back down again.)

What do you predict will happen in the next year? Five years? Ten years?

This activity was adopted from the activity at
http://www.windows.ucar.edu/tour/link=/teacher_resources/Suncycle_edu.html

Parents, this may be advanced for your child, but in case inquiring minds want to know:

Sunspots are dark, planet-sized regions that appear on the "surface" of the Sun. Sunspots are "dark" because they are colder than the areas around them. A large sunspot might have a temperature of about 3,700° C or 6,700° F. This is much lower than the 5,500° C or 10,000° F temperature of the rest of the Sun's atmosphere.

Sunspots are only dark in contrast to the bright face of the Sun. If you could cut an average sunspot out of the Sun and place it in the night sky, it would be about as bright as a full moon. Sunspots have a lighter outer section called the penumbra, and a darker middle region named the umbra.

Sunspots are caused by the Sun's magnetic field welling up to the photosphere, the Sun's visible "surface". The powerful magnetic fields around sunspots produce active regions on the Sun, which often lead to solar flares and Coronal Mass Ejections (CMEs). The solar activity of flares and CMEs are called "solar storms".

Sunspots can last for weeks or even months. The average number of spots that can be seen on the face of the Sun is not always the same, but goes up and down in a cycle. Historical records of sunspot counts show that this sunspot cycle has an average period of about eleven years. The 11 year sunspot cycle is related to a 22 year cycle for the reversal of the Sun's magnetic field. While the cycle has been relatively uniform this century, there have been large variations in the past. From about 1645 to 1715, a period known as the Maunder minimum, apparently few sunspots were present on the Sun. Also during that period, the Earth was much cooler than it was before or is now.

Our Sun isn't the only star with spots. Just recently, astronomers have been able to detect "[starspots](#)" - "sunspots" on other stars.

Although the number of sunspots is the most easily observed feature, essentially all aspects of the Sun and solar activity are influenced by the solar cycle. Because solar activity (such as coronal mass ejections) is more frequent at solar maximum and less frequent at solar minimum, geomagnetic activity also follows the solar cycle. Why is there a solar cycle? No one knows the answer to this question. A detailed explanation of the solar cycle is a fundamental physics problem still waiting to be solved.

Adapted from "Windows to the Universe" at <http://www.windows.ucar.edu/>

Sunspot Numbers

Year and Number of Sunspots	1936	80	Year and Number of Sunspots	1969	106
Year and Number of Sunspots	1937	114	Year and Number of Sunspots	1970	105
Year and Number of Sunspots	1938	110	Year and Number of Sunspots	1971	67
Year and Number of Sunspots	1939	89	Year and Number of Sunspots	1972	69
Year and Number of Sunspots	1940	68	Year and Number of Sunspots	1973	38
Year and Number of Sunspots	1941	48	Year and Number of Sunspots	1974	35
Year and Number of Sunspots	1942	31	Year and Number of Sunspots	1975	16
Year and Number of Sunspots	1943	16	Year and Number of Sunspots	1976	13

Year and Number of Sunspots	1944	10	Year and Number of Sunspots	1977	28
Year and Number of Sunspots	1945	33	Year and Number of Sunspots	1978	93
Year and Number of Sunspots	1946	93	Year and Number of Sunspots	1979	155
Year and Number of Sunspots	1947	152	Year and Number of Sunspots	1980	155
Year and Number of Sunspots	1948	136	Year and Number of Sunspots	1981	140
Year and Number of Sunspots	1949	135	Year and Number of Sunspots	1982	116
Year and Number of Sunspots	1950	84	Year and Number of Sunspots	1983	67
Year and Number of Sunspots	1951	69	Year and Number of Sunspots	1984	46
Year and Number of Sunspots	1952	32	Year and Number of Sunspots	1985	18

Year and Number of Sunspots	1953	14	Year and Number of Sunspots	1986	13
Year and Number of Sunspots	1954	4	Year and Number of Sunspots	1987	29
Year and Number of Sunspots	1955	38	Year and Number of Sunspots	1988	100
Year and Number of Sunspots	1956	142	Year and Number of Sunspots	1989	158
Year and Number of Sunspots	1957	190	Year and Number of Sunspots	1990	142
Year and Number of Sunspots	1958	185	Year and Number of Sunspots	1991	146
Year and Number of Sunspots	1959	159	Year and Number of Sunspots	1992	95
Year and Number of Sunspots	1960	112	Year and Number of Sunspots	1993	55
Year and Number of Sunspots	1961	54	Year and Number of Sunspots	1994	30

Year and Number of Sunspots	1962	38	Year and Number of Sunspots	1995	18
Year and Number of Sunspots	1963	28	Year and Number of Sunspots	1996	9
Year and Number of Sunspots	1964	10	Year and Number of Sunspots	1997	22
Year and Number of Sunspots	1965	15	Year and Number of Sunspots	1998	64
Year and Number of Sunspots	1966	47	Year and Number of Sunspots	1999	93
Year and Number of Sunspots	1967	94	Year and Number of Sunspots	2000	119
Year and Number of Sunspots	1968	106	Year and Number of Sunspots	2001	111