



Sunspots and Solar Flares: Exploring Solar Cycle 24



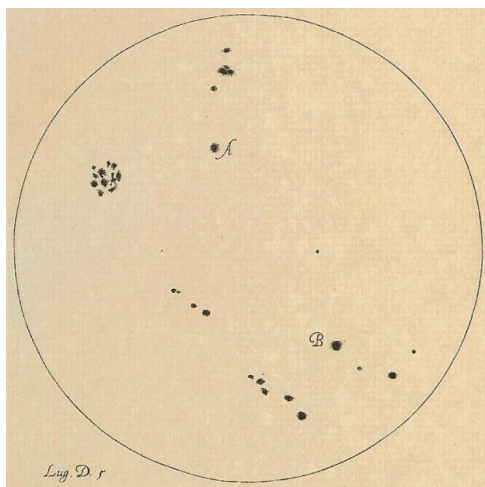
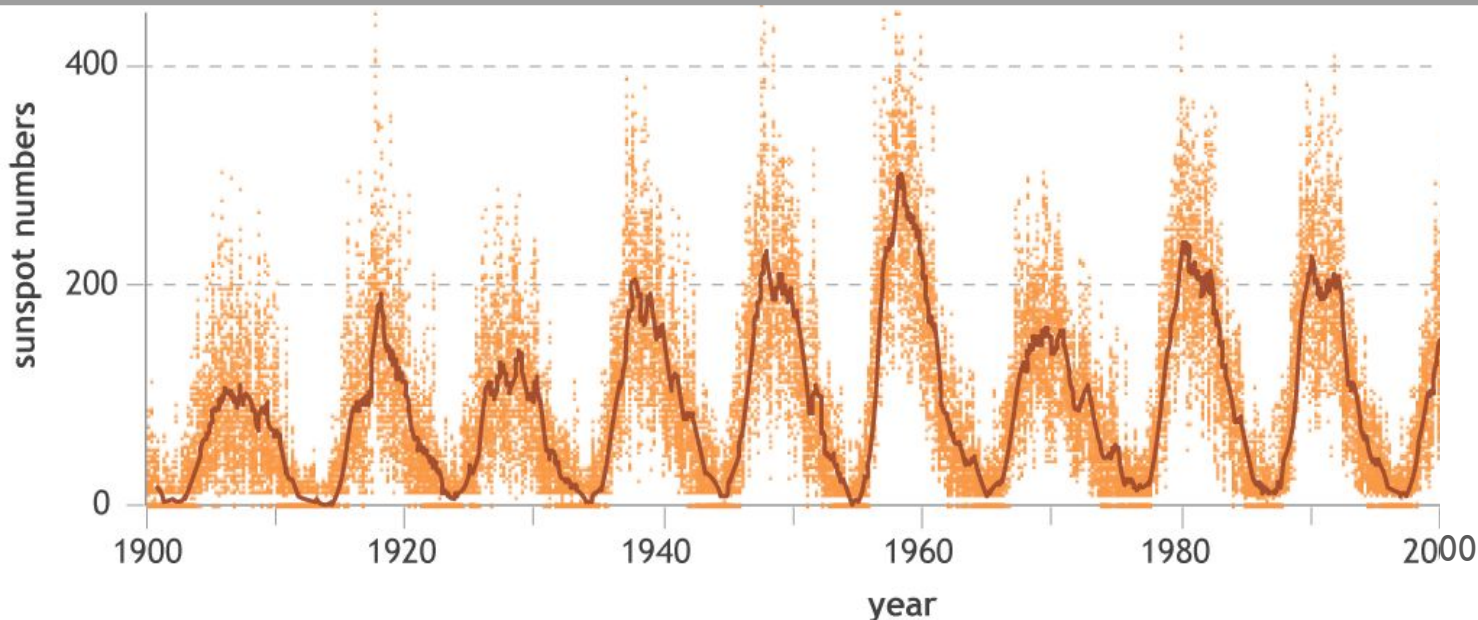
Name _____

Solar Cycle 24 started in December 2008 and ended in December 2019. This activity uses data from 2009-2019, and can be found on:

<https://www.spaceweatherlive.com/en/solar-activity/solar-cycle.html>.

What is the Solar Cycle?

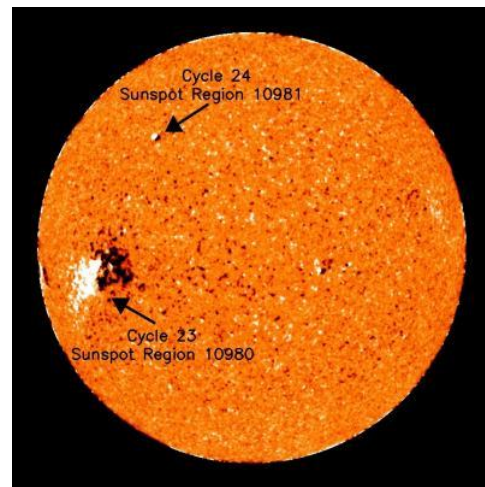
Solar activity has a regular cycle. The start of the cycle features little activity and is called Solar Minimum. The middle of the cycle features a lot of activity and is called a Solar Maximum. The whole cycle lasts about 11 years. Solar Minimums and Maximums are determined by analyzing the number of sunspots. The first Solar Cycle started in 1755.



Sunspots viewed by Galileo, July 1613

What are Sunspots?

Sunspots are areas on the sun that appear darker. They are created by very strong and concentrated magnetic fields. The earliest recorded observation of sunspots is from China around the year 800 BCE. The first sunspot observations with telescopes were in the 1600s.



Sunspots viewed by the Space Weather Prediction Center, Dec 2008

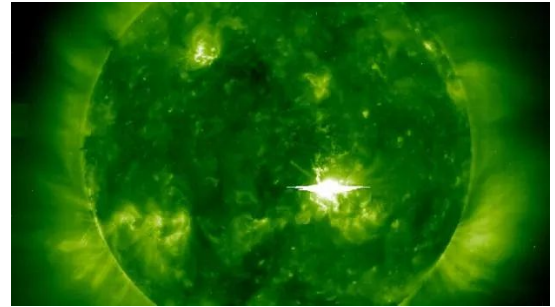
Graphing Sunspots

- 1) Find the page labeled “Graphing Solar Cycle 24”. The first graph is for sunspots.
- 2) Note the X axis is the year. The Y axis is the number of sunspots.
- 3) Make a line graph using the data in the table below:

| Number of Sunspots | | | | | | | | | | |
|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 2009: | 2010: | 2011: | 2012: | 2013: | 2014: | 2015: | 2016: | 2017: | 2018: | 2019: |
| 5 | 25 | 81 | 86 | 94 | 113 | 70 | 40 | 22 | 7 | 4 |

What are Solar Flares?

Solar flares are large eruptions of electromagnetic radiation that occur near sunspots. These sudden outbursts of electromagnetic energy travel at the speed of light, and can last from minutes to hours. M and X class flares are the largest.



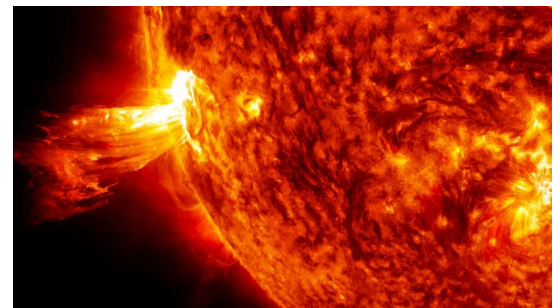
Graphing Solar Flares

- 1) The middle graph is for solar flares. Make a line graph using the data in this table:

| Number of Solar Flares (M & X class) | | | | | | | | | | |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 2009: | 2010: | 2011: | 2012: | 2013: | 2014: | 2015: | 2016: | 2017: | 2018: | 2019: |
| 0 | 30 | 189 | 203 | 186 | 344 | 195 | 28 | 56 | 0 | 0 |

What are Coronal Mass Ejections?

Coronal Mass Ejections (CMEs) are large clouds of plasma and magnetic fields hurled into space from the Sun. The ejected material can travel a million or more miles per hour.



Graphing Coronal Mass Ejections

- 1) The graph on the right is for CMEs. Make a line graph using the data in this table:

| Number of Days with a Coronal Mass Ejection | | | | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 2009: | 2010: | 2011: | 2012: | 2013: | 2014: | 2015: | 2016: | 2017: | 2018: | 2019: |
| 109 | 102 | 89 | 128 | 158 | 138 | 108 | 76 | 89 | 120 | 103 |

Analysis

- 1) Looking at the Sunspot graph, what years did Solar Minimum occur? What years did Solar Maximum occur?
- 2) Look at the Solar Flare graph. How is this graph similar to the Sunspot graph? How is it different?
- 3) Look at the Coronal Mass Ejection graph. How is this graph similar to the Sunspot graph? How is it different?
- 4) Are there any visible sunspots today? Find a recent view of the sun on spaceweather.gov. Draw sunspots and any other interesting features you see:

