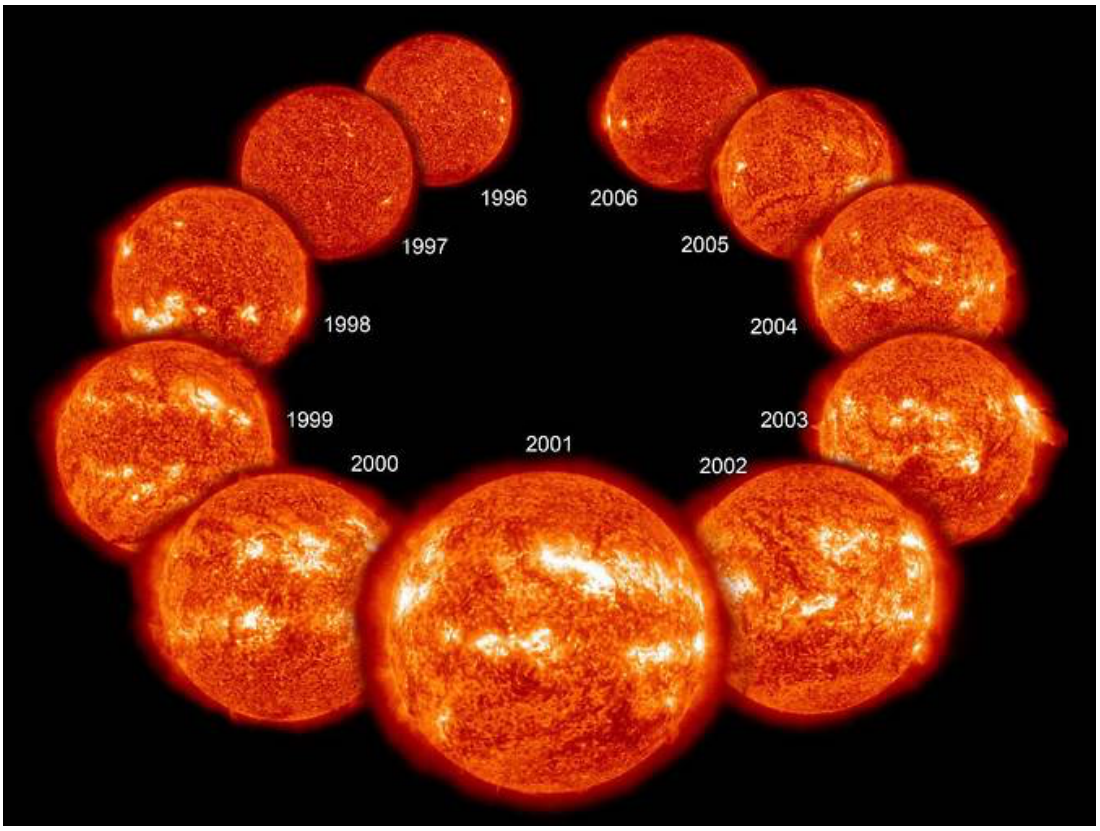
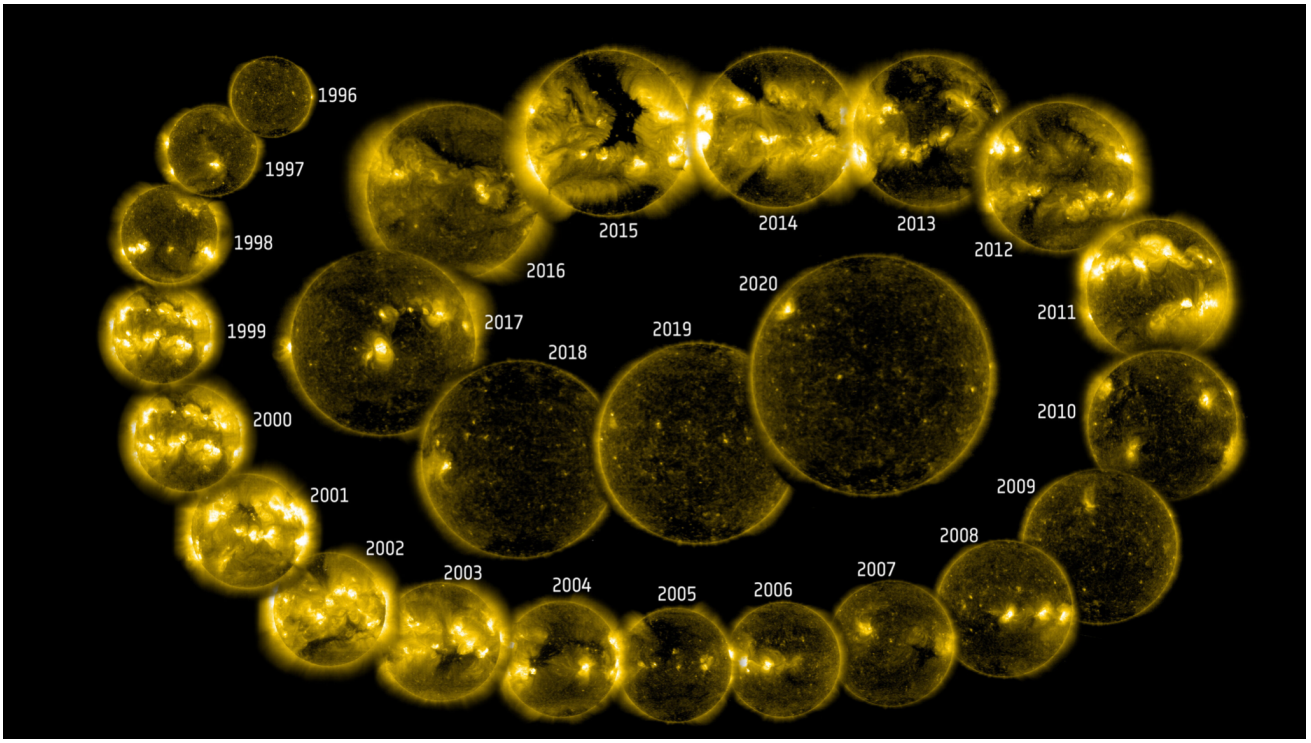
Please refer to the Teacher Resource document for information on how to use the worksheet for the activity.

Q1. Examine the images of the Sun.



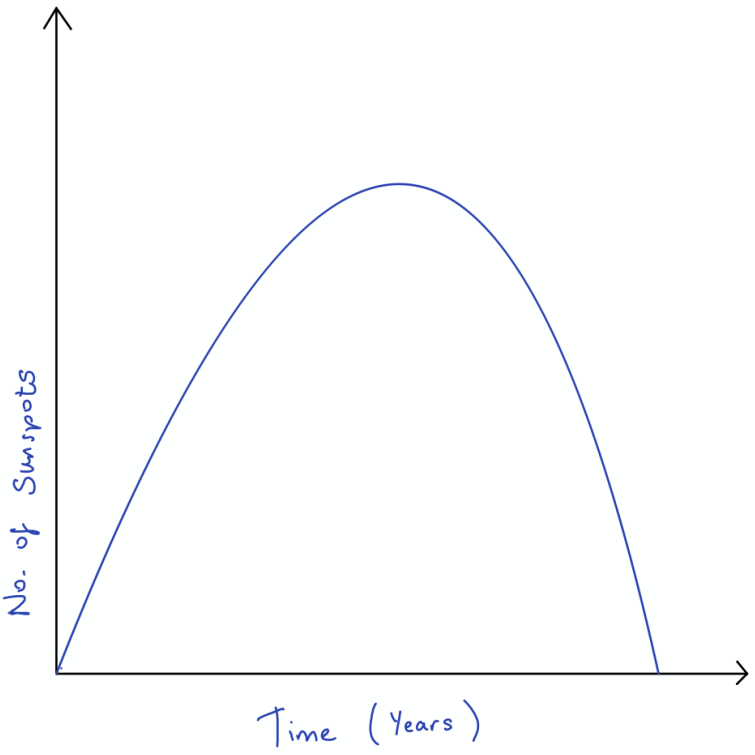


a) Describe why you think the Sun looks different in each image.

Expected Responses:

- I know from activity 2 that the Sun has sunspots and they move across the Sun so the Sun will look different if the sunspots are moving to different places.
- The Sun has explosions in some images and not in others so that means that the Sun will look different at certain times.
- From the images in Q1. it looks like there are years when the Sun has lots of explosions and years when it doesn't have any explosions.
- From activities 3, 4, 5 and 6 I learned that the Sun is made of plasma and it moves around a lot because the Sun is so hot. This might make the Sun look different at different times. The plasma also causes magnetic field loops so maybe sometimes there is lots of moving plasma in one spot and that might cause bigger loops and smaller loops in places where there is not a lot of moving plasma.

b) If you wanted to draw a graph to explain the number of sunspots visible on the Sun in Image 1 as the time passes, what would the graph look like? Sketch your graph and label your axes.



Q2. a) When your teacher has assigned a group number, open the matching Excel file. The table in each Excel sheet gives the **daily average of visible sunspots for each year.** For example on average 12 sunspots were visible each day for the year 1996. Plot this data using Excel and describe your observations of the graph.

My observations:

The graph should look similar to a Sine wave. The Sun has an 11-year cycle that follows the pattern of a Sine function. There are points of solar maximum (lots of sunspots are visible and solar eruptions occurring) and points of solar minimum (little to no sunspots visible and no solar eruptions occurring).

Expected Responses:

- The graph looked like an 'n' shape or a mountain shape.
- This looks like a graph for a quadratic function.

Q2. b) How does the Excel graph compare to your sketched graph in Q1. b) ?

Expected Responses:

- It looks the same as the way I sketched it.
- It looks different to the way I sketched it in Q1. b).

Q2. c) Examine your Excel graph and answer the following questions:

1. What year has the highest number of sunspots visible per day?
2. What year has the lowest number of sunspots visible per day?
3. How long does it take for the Sun to change from its highest number of sunspots visible per day to its lowest?
4. What year do you think it is most likely for scientists to detect solar eruptions from the sunspots?

Expected Responses:

For excel sheet 1:

1. 1989
2. 1996
3. 7
4. 1989 because that is when the highest number of sunspots are visible and from activity 2 I learnt that sunspots cause solar eruptions.

For excel sheet 2:

1. 2000
2. 2008
3. 8
4. 2000 because that is when the highest number of sunspots are visible and from activity 2 I learnt that sunspots cause solar eruptions.

For excel sheet 3:

1. 2014
2. 2019
3. 5
4. 2014 because that is when the highest number of sunspots are visible and from activity 2 I learnt that sunspots cause solar eruptions.

Q2. d) Working in larger groups, combine each of your tables of data into one Excel sheet. Plot this larger table of data using Excel and describe your observations of the resulting graph.

My observations:

Expected Responses:

- The graph follows a sideways 'S' shape.
- The graph looks like it's repeating itself, there is some variation but approximately the same shape.

- The peaks occur approximately every 11-14 years.
- The gap between peaks is approximately the same. 1989 → 2000 → 2014

Q2. e) Compare your graph in Q2. a) to your graph in Q2. d). How does the pattern change when the full data set is used? What does this tell you about the climate of the Sun?

As this is a real-world dataset the pattern is periodic. The Sun is said to have an approximate 11-year cycle of solar activity.

Expected Responses:

- It looks like the graph in Q2. a) is just repeated three times to make the graph of the full dataset in Q2 d).
- This pattern of repeating curves tells me that the climate of the Sun follows a repeating pattern. The number of sunspots increases, reaches a maximum and then decreases to a minimum every 11-14 years.
- This means that there is a cycle or pattern that the Sun follows - so it is like having a climate on Earth (e.g. every year in Ireland it rains in July). Every 11-14 years the Sun has lots of sunspots and lots of solar eruptions.