**Guided Notes: Sun’s Magnetism**

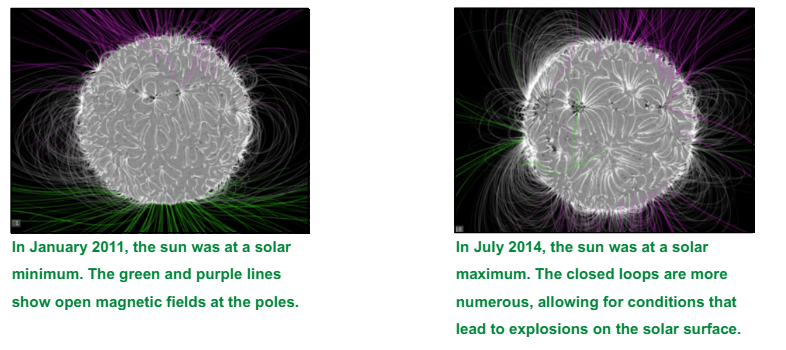


Like all stars, the sun is composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, a type of super-heated \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in which the particles are \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Streams of these particles, called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ wind, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the solar system. Most of the sun’s properties are generated by processes in its complex \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Key Concepts:**

* While \_\_\_\_\_\_\_\_\_\_\_\_\_\_ have been observed by people for perhaps \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of years, it is only recently that scientists have learned what causes them.
* The activity \_\_\_\_\_\_\_\_\_\_\_\_\_\_ on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the sun can be explained by the sun’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_ properties.
* On Earth most matter is made of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* By contrast, most of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_, including the sun, is made of \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is matter that has been heated to such a degree that some of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ are \_\_\_\_\_\_\_\_\_\_\_\_\_\_ off their atoms, resulting in a swirling \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of charged \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* A flow of electrically charged \_\_\_\_\_\_\_\_\_\_\_\_\_\_ can generate a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ field.
* The sun \_\_\_\_\_\_\_\_\_\_\_\_\_\_ around an \_\_\_\_\_\_\_\_\_\_\_\_\_\_ much like Earth does, but because it is made of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, it does not \_\_\_\_\_\_\_\_\_\_\_\_\_\_ evenly.
* A point on the sun’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_ takes 25 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to make a full rotation, while a point on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ takes up to 35 \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* So the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the sun is constantly \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* The differential \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ results in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ fields that ebb and flow.
* This system that produces the magnetic fields of the sun is called the solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_, named after the device that generates an electric \_\_\_\_\_\_\_\_\_\_\_\_\_\_ via a moving \_\_\_\_\_\_\_\_\_\_\_\_\_\_ field.
* Often, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ magnetic fields pop out of the sun’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_, acting like horseshoe \_\_\_\_\_\_\_\_\_\_\_\_\_\_ with \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ end.
* These regions are slightly \_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the rest of the sun’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_, so they appear \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in \_\_\_\_\_\_\_\_\_\_\_\_\_\_. These \_\_\_\_\_\_\_\_\_\_\_\_\_\_ spots are what we observe as \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* The ebbs and flows of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ field of the sun are \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* For several years the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ field of the sun tends to line up with the two \_\_\_\_\_\_\_\_\_\_\_\_\_\_, and sunspots \_\_\_\_\_\_\_\_\_\_\_\_\_\_ almost completely.
* This is called a solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Several years later, the magnetic fields grow more \_\_\_\_\_\_\_\_\_\_\_\_\_\_, resulting in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and other activity on the surface of the sun.
* This is called a solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_. It takes about 11 years for the sun to go through one \_\_\_\_\_\_\_\_\_\_\_\_\_\_.



* The solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_ drives the sun \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* At the solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_, the sun’s magnetic field is mostly \_\_\_\_\_\_\_\_\_\_\_\_\_\_ out and its field lines are \_\_\_\_\_\_\_\_\_\_\_\_\_\_ towards the North and South \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* At the solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_, the field is more \_\_\_\_\_\_\_\_\_\_\_\_\_\_, resulting in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ solar events. Complex computer calculations model the positions of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ field lines.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_ are not the only feature associated with the sun’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_ magnetic field of the sun also results in dramatic \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* These can even interfere with and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ electronic equipment on \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ mass ejections are closely associated with \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* These often, but not always, occur at \_\_\_\_\_\_\_\_\_\_\_\_\_\_, and they \_\_\_\_\_\_\_\_\_\_\_\_\_\_ occur at the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ time.
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_ explosion in the solar system is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ flare, which occurs when some of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is released, equal to the amount of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in millions of 100-megaton hydrogen bombs \_\_\_\_\_\_\_\_\_\_\_\_\_\_ at once.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of almost every \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the electromagnetic \_\_\_\_\_\_\_\_\_\_\_\_\_\_, including \_\_\_\_\_\_\_\_\_\_\_\_\_\_ light, is released.
* Solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_ can last from a few \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to an \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_ can only be seen using specialized \_\_\_\_\_\_\_\_\_\_\_\_\_\_ on Earth or in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ around Earth, but their \_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_ when they \_\_\_\_\_\_\_\_\_\_\_\_\_\_ with \_\_\_\_\_\_\_\_\_\_\_\_\_\_ transmissions.
* Sometimes a large \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ field of the sun can \_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the surface, usually at \_\_\_\_\_\_\_\_\_\_\_\_\_\_, carrying with it an enormous bubble-shaped mass of solar \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* This is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ mass ejection (CME).
* These \_\_\_\_\_\_\_\_\_\_\_\_\_\_ expand as they \_\_\_\_\_\_\_\_\_\_\_\_\_\_, carrying as much as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ tons of matter \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of miles per hour through space.
* CMEs often occur at the same time as \_\_\_\_\_\_\_\_\_\_\_\_\_\_ flares.