When a solar coronal mass ejection collides with earth's magnetic field, it can produce intense aurora that can be seen from the ground. Geophysicists who study magnetic disturbances have created a 9-point scale that indicates how intense the storm is. Kp=9 is the most intense, and aurora can be seen near Earths equator for many of these. Kp=7 and 8 are strong storms that can still cause aurora and upset electrical power systems. Kp=5 and 6 are mild storms that may or may not produce intense aurora.

The table below gives the dates when magnetic storms were detected that exceeded Kp=4. The multiple entries each day indicate consecutive 3-hour measurements of the storm intensity. The data are given for the 227 days from January 1, 2013 to August 15, 2013. Highlighted boxes in yellow indicate days when Halo CMEs were detected

Date	Kp measurements	Date	Kp Measurements
3-1	5	6-2	5
3-17	6, 5, 5, 6, 6, 5	6-7	5, 6, 5
3-29	5	6-29	6, 7, 5, 6
3-30	5, 5	7-10	5, 5
4-26	5	7-11	5
5-18	5, 5	7-15	5, 5
5-24	5	8-4	5
5-25	5, 5, 5	8-5	5
6-1	6, 6, 6, 5, 6		

Problem 1 – What percentage of the days during this time period had magnetic storm events?

Problem 2 – What percentage of the magnetic storm days were strong storms with Kp=6 or higher?

Problem 3 – During this same 227-day period of time, there were 12 Halo CMEs detected. What is the probability that these Halo events produce a magnetic storm with Kp=6 or higher?

Problem 4 – The Kp index is measured every 3 hours. From the table, what is the average duration of a storm that exceeds Kp=5 during its entire duration?

Problem 1 – What percentage of the days during this time period had magnetic storm events?

Answer: 17 days out of 227 so 100% x (17/227) = **7%**

Problem 2 – What percentage of the magnetic storm days were strong storms with Kp=6 or higher?

Answer: 4 out of 17 or 100% x (4/17) = **24%.**

Problem 3 – During this same 227-day period of time, there were 12 Halo CMEs detected. What is the probability that these Halo events produce a magnetic storm with Kp=6 or higher?

Answer: Only 2 of the 12 Halo CMEs produced Kp=6 or stronger magnetic storms, so P = 100% x (2/12) = **17%.** The odds were 1 in 6.

Problem 4 – The Kp index is measured every 3 hours. From the table, what is the average duration of a storm that exceeds Kp=5 during its entire duration?

Answer: There were 4 storms that exceeded Kp=5. These occurred on the dates: 3-17, 6-1, 6-7 and 6-29. The total hours for each storm were
6x3 = 18 hours (for 3-17),
5x3 = 15 hours (for 6-1);
3x3 = 9 (for 6-7) and
4x3 = 12 (for 6-29).

The average for these hours is (18+15+9+12)/4 = **14 hours.**

So, once a strong magnetic storm begins, it takes about one-half a day for it to reach its maximum intensity and then fade away. If this happens in the summertime during the day, you will not see an aurora borealis because of the daylight brightness.