The Stratospheric Aerosol and Gas Experiment III (SAGE III), the sensor will be installed on the International Space Station (ISS) sometime in 2014. SAGE III will be using the sun and moon as light sources to measure how well the ozone layer is recovering and replenishing itself.

The 76-kilogram instrument will be carried in a Dragon supply module, and launched on a SpaceX, Falcon 9 rocket from NASA's Kennedy Space Center. After installation on the ISS and a 30-day check out, it will start taking data at a rate of about 200 megabytes every day. SAGE-III has a pointing accuracy of 0.025 degrees and requires 700 kilowatt hours of electricity every year.

Problem 1 - A single DVD can store 4.4 gigabytes of data. How many DVDs of data will the SAGE-III experiment generate during its 3-year mission onboard the ISS if 1 gigabyte = 1000 megabytes?

Problem 2 - If 1 kilogram equals 2.2 pounds, what is the weight of the SAGE-III instrument?

Problem 3 - A single 100-watt light bulb that is turned on for 10 hours will consume 1000 watt-hours of electricity, which is called 1 kilowatt-hour. How many watts will the SAGE-III instrument use if it is turned on for one full year?

Problem 4 - The SAGE-III instrument can change its direction of pointing by as little as 0.025 degrees. This is the same angle as the width of a dime (1 cm in diameter) if it were viewed at a distance of 23 meters. If two people stood one meter apart, how far away would they have to be standing from you to subtend the same angle? (Hint: Use proportions)

Problem 1 - A single DVD can store 4.4 gigabytes of data. How many DVDs of data will the SAGE-III experiment generate during its 3-year mission onboard the ISS if 1 gigabyte = 1000 megabytes?

Answer: The instrument produces 200 Mby of data every day. In 3 years it will produce 3 years x (365 days/year) x (200 Mby/day) = 219,000 Mby. Then:

219,000 Mby x (1 Gby/1000 Mby) x (1 DVD/4.4 Gby) = 49.8 DVDS. In terms of the total needed, we have **50 DVDs**.

Problem 2 - If 1 kilogram equals 2.2 pounds, what is the weight of the SAGE-III instrument?

Answer: 76 kg x (2.2 pounds/1 kg) = 167.2 pounds or **167 pounds**.

Problem 3 - A single 100-watt light bulb that is turned on for 10 hours will consume 1000 watt-hours of electricity, which is called 1 kilowatt-hour. How many watts will the SAGE-III instrument use if it is turned on for one full year?

Answer: The SAGE-III instrument uses 700 kWh of electricity. Then:

700 kWh x (1000 W/kW) x (1 year/ 365 days) x (1 day/ 24 hours) = **80 watts.**

Problem 4 - The SAGE-III instrument can change its direction of pointing by as little as 0.025 degrees. This is the same angle as the width of a dime (1 cm in diameter) if it were viewed at a distance of 23 meters. If two people stood one meter apart, how far away would they have to be standing from you to subtend the same angle?

Answer:

$$\frac{1\text{ cm}}{23\text{ meters}} = \frac{1\text{ meter}}{X}$$

convert all units to meters: $\frac{0.01\text{ m}}{23\text{ m}} = \frac{1\text{ m}}{X}$ then $X = 23/0.01 =$ **2300 meters**