Article Review

- *Here Comes the Sun*
- *Dr. Z: Inside the Sun*

Time

10 minutes prep time. 5 minutes presentation time per question

Questions

Teacher: Write out each question on a separate slip of paper and present all questions to the student

1. What are the layers of the Sun and in which layer does fusion take place? In which layer are coronal mass ejections seen during an eclipse? Present a rough scale drawing to support your answer.

(Easy) A: The sun's layers are the core (15%), radiative zone (65%), convection zone (20%), photosphere, chromosphere, corona, outer corona. http://www.solarviews.com/eng/sun.htm. Fusion takes place in the sun's core. Coronal mass ejections can be seen in the chromosphere during an eclipse.

2. Name one of three mysterious or unexplained solar phenomena mentioned in the article. How do scientists believe these three phenomena reflect solar weather trends?

(Medium difficulty) A: The three mysteries are sunspot activity, solar magnetic activity, and the temperature of the chromosphere compared to the temperature of the photosphere. Increased activity in these solar mysteries has been linked to outbursts in extreme solar weather.

3. What solar phenomena help space weather analysts predict the coming of periods of dangerous solar weather?

(Medium difficulty) A: The solar cycle (min to max), sunspots, and increases in microwaves and X-rays from flares seen in the chromosphere.

4. How does the earth's magnetic field and atmosphere help protect the earth from dangerous solar eruptions? List the types of dangerous eruptions. Present a rough scale drawing of the earth-sun relationship to support your presentation.

(Medium Difficulty) A: Earth's magnetic field lines deflect many of the sun's radioactive particles (protons). The Van Allen Belts absorb high-energy particles. X-rays and ultraviolet rays collide with the gases in the earth's ionosphere and are de-energized.

5. Describe the journey a gamma ray may take as it travels from the center of the sun to the earth?

(Difficult) A: The journey could take 15,000,000 years. Gamma rays are produced during fusion. The gamma ray collides with plasma particles in the sun's layers. During each collision they lose energy. Eventually they become X-rays, then visible light, then microwaves, etc. As the electromagnetic energy leaves the sun it travels to the earth at the speed of light. When it hits the ozone layer or the Van Allen Belts it loses additional energy and may eventually strike the earth's surface in the form of visible light, infrared, or ultraviolet energy.

6. How do radioactive (ionized or charged) particles interact with magnetic field lines around the earth? What examples can you give of this interaction?

(Easy) A: Radioactive particles may follow the magnetic field lines down to the earth and enter the earth at the poles or they may be intercepted by the ionosphere and create what we see as Northern or Southern lights. They may also form a highly charged power grid above the earth.

7. Why is Space Station Alpha vulnerable to dangerous solar eruptions?

(Medium difficulty) A: SSA orbits above some of the earth's protective atmospheric layers and travels through the earth's magnetic field lines. It also travels through the South Atlantic Anomaly, the lowest level of the Van Allen belt. Because of this it can behave as a lightning rod for the electrically charged particles that can in turn interrupt the electrical systems on board the space station.

8. Consider the following quote: "In that second, 700 million tons of hydrogen ions, banging around at almost 15,000,000 Celsius fused together to form 695 million tons of helium and a teeny amount of assorted random elements." What happens to the 5 tons of matter that is not accounted for. What formula explains this transformation of matter?

(Medium difficulty) A: The matter is transformed into energy in the form of gamma rays. Einstein's formula $E=mc^2$ explains this process. E=gamma rays. M = mass lost. C = speed of light (186,000 m/sec) which is squared.