Name(s)_____ Date_____

The Energy of Moving Matter, Great and Small

Background: One cold clear winter night in 1991, a single subatomic particle came hurtling through the atmosphere destroying atoms, causing the air to glow, and in general behaving like a normal cosmic ray, except for its energy. This single cosmic rayhad an energy of nearly 1020 electron volts, or nearly 50 joules! To put it in perspective,that is roughly equivalent to a 1 kg mass moving at 10 m/s, or a 90 mph fastball. The energy of a fastball is shared by 1025 atoms. Imagine one atomic nucleus having all that energy! This was the most energetic cosmic ray ever recorded, and it was observed bythe University of Utah's Fly's Eye detector.

The Fly's Eye detector is a detector that "looks" for cosmic rays. Of course cosmic raysare sub-atomic particles and are far to small to actually be seen. What the detector actually sees is the trail left by the cosmic ray as it bumps into the nitrogen in the atmosphere. The Fly's Eye detector is a series of mirrors, each pointed in a different direction. Because the mirrors are pointed all around, the Fly's Eye detector can "see" in all directions, the same as a fly. Which is why it is named the Fly's Eye detector.

Statement of Purpose: Scientists studying cosmic rays must know about the energy that cosmic rays have. The purpose of this lab is to investigate the relationship between mass, speed and energy.

Materials: Computer with Internet connection and lab notebook.

Procedure: Your teacher will instruct you on how to access the lab site. Follow those directions carefully.

Once you have accessed the lab site you will want to follow the instructions on the introductory pages. Read each page carefully, so that you know how to complete the lab.

Record the data on a data table. You will want to complete at least 8 trials. Try to find different objects, moving at different speeds, that have the same energy!

Table 1: Investigation 1

Mass (kg)	Speed (m/s)	Energy (J)

Questions: Using the data you just collected answer the questions below.

1) What happens to the kinetic energy when you increase the mass?

2) What happens to the kinetic energy when you increase the speed?

3) Did any of the thrown objects have energies that are close or identical? List the trials with the same energy.

4) From your results so far what can you conclude about the relationship between mass, speed and energy?

In the next investigation you will be able to determine exactly how these variables affect one another.