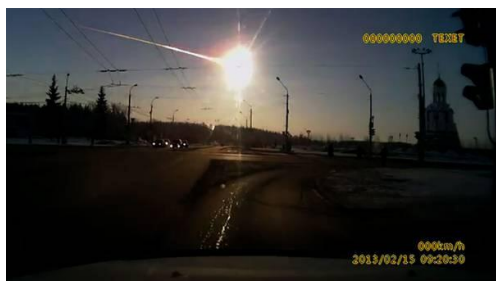


ENERGY

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A Clearer View of the Space Bullet That Grazed Russia



INTRODUCTION: The object of the exercise is to verify that this meteor traveling at 42,000 mph and having a mass of 11,000 metric tons has a energy equivalent of 440 kilotons of TNT. Look at multimedia here.

QUESTIONS: (a) Convert 42,000 mph to m/s? (b) Convert 11,000 metric Tons to kg.? (c) Find kinetic energy of this meteor? (d) Convert 440 Kilotons of TNT to J(Joules) of energy? (e) How well does (c) and (d) compare?

YouTube Videos Unlock Meteor's Secrets: Scientists around the world have been using videos made by Russian citizens and uploaded to YouTube to figure out exactly where the meteor that exploded over Russia on Feb. 15 came from.

Using an eclectic mix of crowd-sourced video, information from Google Earth and data from nuclear test-ban sensors, scientists have gotten a much more accurate picture of the small [asteroid that exploded](#) near the Russian city of Chelyabinsk last month.

Multimedia



HINTS: $0.447 \text{ m/s} = 1 \text{ mph}$, metric ton = 1000 kg.
 $1 \text{ kiloton TNT} = 4.186 \times 10^{12} \text{ J}$, kinetic energy = $\frac{1}{2} mv^2$

ANSWERS: (a) $1.8774 \times 10^4 \text{ m/s}$ (b) $1.1 \times 10^7 \text{ kg}$. (c) $1.938 \times 10^{15} \text{ J}$
(d) $1.842 \times 10^{15} \text{ J}$ (e) _____.

A Meteorite Striking Through the Sky From Six Vantage Points



A Meteorite Rush

The Russian meteor — which, according to the latest estimates, was about 60 feet in diameter and came in undetected at roughly **42,000 miles an hour** — was almost 15 miles high when it blew apart. There were no deaths, and most of the 1,500 injuries were from glass as windows shattered when a shock wave hit the city 88 seconds later. Still, the Canadian team has calculated that the energy released in the **Chelyabinsk explosion was the equivalent of about 440 kilotons of TNT**, or about 30 times the power of the Hiroshima bomb. With knowledge of the energy and information about how fast the meteor was traveling, researchers were then able to calculate the **mass of the meteor, about 11,000 metric tons**. “It’s all about the kinetic energy of that body,” which is related to its mass and velocity, said Richard P. Binzel, a planetary scientist at the Massachusetts Institute of Technology. The meteor has a certain amount of energy as it enters the atmosphere, Dr. Binzel said. As it hits the air, it starts to decelerate quickly, and then the stress differential between the superpressurized air in front and the less-pressurized air behind causes the rock to break apart violently. “All that kinetic energy has to be released,” he said. Only small fragments of the meteor reached the ground, and some have been brought to laboratories in the United States, including the [Institute for Rock Magnetism](#) at the University of Minnesota, where a Russian scientist is studying their magnetic properties.