

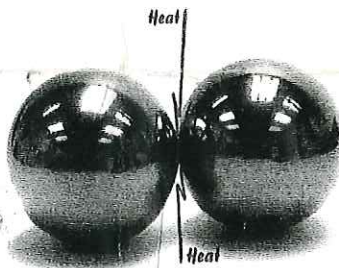
Educational Innovations[®]

#HS-8

Smashing Steel Spheres

By Ron Perkins

When two, 1-pound, 2-inch diameter steel spheres are smashed together, enough heat is generated at the point of contact to burn a hole in a piece of paper.



Procedure:

- A. Place a sphere in each hand and hold your hands about 1-meter apart. Then quickly move your hands together until the steel spheres collide and bounce off. Repeat with an assistant holding a piece of paper vertically at the point of collision. Smell and examine the paper. If a microscope is available, one can see burnt specks of carbon and concentric ripples in the paper.
- B. Repeat with a piece of aluminum foil instead of the paper. A number of concentric rings are observed in the foil.

Explanation:

This amazing demonstration visually illustrates the conversion of kinetic energy into heat energy. The kinetic energy of the two heavy moving spheres is converted into heat at the point of collision.

The size of the spheres is critical. Smaller than 2" metal spheres, there is not enough mass; larger than 2" spheres there is too much surface area on collision. No matter how hard you smash a ball peen hammer onto an anvil with a paper in between, you do not get a hole or ripples in the paper. Like in the story of *Goldilocks and the Three Bears*, 2-inch spheres are just right! Many believe that at the point of collision, a shock wave travels through the paper or foil. Under a microscope one can see little specks of carbon and ripples in the paper similar to the ripples in aluminum foil.

Additional Experimentation:

Twelve years ago, the Smashing Spheres demonstration was demonstrated to a group Teachers in Dr. Larry Peck's, AP summer program at Texas A&M, taught by Kristen Jones and Lisa McCaw. One enterprising teacher tried the demonstration later that evening with some old spheres that he had around the house. Imagine his surprise when he obtained sparks after colliding the rusty spheres together with a piece of aluminum foil held in between. He had rediscovered the thermite reaction: $\text{Fe}_3\text{O}_4 + \text{Al} \rightarrow \text{Fe} + \text{Al}_2\text{O}_3 + \text{Heat \& Sparks}$

Since then, there has been a frantic search for rusty spheres. It is possible to rust the Educational Innovations ones, but it is usually a slow process. Dr. David Shaw, MATC in Madison, WI, has reported that a few months in the presence of fumes from the chemical storage closet works well.

Acknowledgement: In 1995, Dr. Joseph Wesley, a physics teacher at Greenwich High School showed me the smashing steel sphere demonstration. We then attempted to locate its origin. After talking sequentially with a series of physics teachers, we concluded the originator is unknown.



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