

Name: _____ Date: _____

m_r^β **Physics Practice: Relativity and Energy**

Particles with mass obey different equations. Thanks to Einstein, some of the familiar equations we learned from Newton need to be modified to accommodate *relativistic speeds* (those approaching the speed of light c). As a particle approaches light speed (relative to our frame of reference), the particle's momentum increases without bound, according to

$$\vec{p} = \frac{m_0 \vec{v}}{\sqrt{1 - v^2/c^2}} \quad (1)$$

where m_0 is the *rest mass* (i.e. mass when measured at rest).

Kinetic energy is given by

$$\text{KE} = m_0 c^2 \left(\frac{1}{\sqrt{1 - v^2/c^2}} - 1 \right) \quad (2)$$

1. Superman is playing baseball with the Green Lantern. Just to be safe, they decide they better play in space. Superman throws a wild pitch, at $0.99c$, which strikes the moon. The baseball has a rest mass of 142.5 grams.

a. Calculate the kinetic energy of the ball in Joules.

b. What is the equivalent number of megatons of TNT?