

Mass-Energy Equivalence

Physics

What $E = mc^2$ actually asserts.

The total energy of a body includes a rest energy equal to its mass times c squared.

$$E = \gamma mc^2 \cdot E_0 = mc^2 \cdot E^2 = (pc)^2 + (mc^2)^2$$

1 kg of anything

Enormous.

9×10^{16} J of rest energy

Photon

Zero mass.

$E = pc$

Nuclear fusion

About 0.7% of mass converted

THE COMMON MISTAKE

✗ **Saying mass turns into energy**

✓ **Mass is energy**

Nothing is converted between different substances. The rest energy is released as kinetic energy and radiation.

Most of a proton's mass is not from its quarks. It is binding energy of the strong field — mass from energy, not the reverse.