Name: _____ Date: _____

# Conserve Energy—That's the Law!


In the eighteenth century, scientists were learning about many forms of energy, but they were confused about the nature of **heat,** which seemed to be an unwanted byproduct of many energy transformations—usually resulting from the friction between moving parts of machinery. They thought of heat as a weightless substance called **caloric.** Some of the kinetic energy of moving parts always turned into this somewhat mysterious caloric.

Then a man named **James Prescott Joule** (Remember that name?) thought of a clever experiment that showed that the amount of heat generated could be precisely connected to the mechanical energy of motion. He measured the rise in temperature of the water in a beaker caused by the rotation of a paddlewheel turned by a falling weight. He found that the same amount of mechanical energy always produced the same amount of heat. Heat was a form of energy, too! When scientists carefully measured all the forms of energy (including heat) involved in any activity, they found the total amount of energy was always the same before and after, even though energy forms had changed. *They discovered that energy is conserved*—a fundamental scientific concept. This is usually stated as the **Law of Conservation of Energy:** energy can neither be created nor destroyed.

Another scientist with whom most people are familiar, **Albert Einstein,** made a discovery that modified this law in one important way. He found a relationship between mass and energy that is written **energy (e) = mass (m) x $c^2$** or **($e = mc^2$)**. The "c" is a letter standing for the speed of light, a very large number. Square that number, and you get an even more enormous number. The equation means that a small amount of mass can be—under extraordinary conditions, like at the center of a star—converted to a HUGE amount of energy. (Nuclear bombs later demonstrated that on Earth.) So now the Law of Conservation of Energy is usually stated: energy can neither be created nor destroyed by ordinary means. The total amount of mass *and* energy before and after any event is always the same.


1. T or F? Sometimes energy is lost during a chemical reaction.
2. Newspapers often talk about an energy crisis—about running out of certain energy sources in the not-too-distant future. About which kind of energy sources are they talking?

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   If energy can neither be created nor destroyed, into what kinds of energy have these resources been transformed? _____
3. Explain why the phrase "by ordinary means" was added to the Law of Conservation of Energy. _____

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4. James Joule showed that _____ was a form of energy.