HEAT UNITS

Physicists originally defined calories as a unit of heat before they knew that heat is a form of energy. A calorie is the amount of heat required to raise the temperature of 1 gram of water from 1 degree Celsius.

Physicists seldom use calories to measure quantities of energy any more, but they are commonly used to measure the energy content of food and the energy requirements of various physical activities.

There is however a complication. The calories used to measure the energy contained in food (food calories) are really kilocalories (1000 calories). So that 100-calorie snack really contains 100,000 calories, and 100 calories worth of exercise really burns 100,000 calories. So 1 food Calorie = 1 exercise Calorie = 1000 calories = the amount of heat required to raised 1 kg (2.2 lbs.) of water 1 degree Celsius.

BTU is an abbreviation for British thermal unit. As for calories, the BTU is a measure of heat required to raise the temperature of water. One BTU is the amount of heat required to raise the temperature of 1 pound of water by 1 Fahrenheit degree. 1 BTU equals 252 calories.

James Prescott Joule first proved that heat was a form of energy so the unit of energy most commonly used by physicists, joules, was named after him.

A joule is the amount of energy required (or work performed) when applying a force of 1 newton (1 newton = 0.2248 pounds) over a distance of 1 meter. There is a famous legend about apples falling on Isaac Newton's head, and a small apple weighs roughly one newton. So think of a joule as roughly the energy required to lift an apple from the floor to a table, roughly 1 meter.

One can also understand how much energy a joule is by noting that a 100 watt light bulb emits 100 joules of energy each second. To convert between joules and calories, 1 calorie equals 4.186 joules.

An erg is a very small energy unit that is still occasionally used by scientists. An erg is 1 ten millionth of a joule. (1 erg=1E-7 joule) Think of an erg as very roughly the amount of energy it takes a flea to jump.

Converting all the different units above to Joules (the most excepted unit of energy) would give

1 Joule = 0.23889 calories = 0.00023889 Calories = 0.000948 BTU's = 10,000,000 ergs

Converting all the different units above to Calories (food or exercise Calories) would give

1 Calorie (food or exercise) = 1000 calories (science) = 4,186 J = 3.968 BTU's = 4.186×10^{10} ergs

See if you can catch this ***** 1 Pound = 3,500 Calories (food or exercise) = 14,644,000 Joules**

So to lose 1 pound of stored energy (fat) on your body, you would have to do 14,644,000 Joules of Work.

Let's say you weigh 140 lbs, thus on Earth have a mass of 140 lbs/2.2 lbs./kg = 63.64 kg and climbed the steps up to Physics once. The approx. height 5.1 meters so

P.E. = mgh = (63.64 kg)(9.8 m/s^2)(5.1m) = 3181 Joules or you would have to climb the steps 14,644,000/3181 = 4,604 times to lose 1 pound of fat.

Thus a 100 Calorie little candy bar = 418,600 Joules of Energy would take 132 times up the steps to Physics to burn off. However if you think of Michael Phelps the swimmer or anyone who needs a lot of energy, it is great to think a little candy bar can give you enough energy to do that much exercise.