In section 13.4, we stated that energy must be conserved: Ei+Ein-Eout=Ef. Moving things around we get Ef-Ei= Ein- Eout. Recognizing the term on the left as E, we can say E=Ein-Eout. If we redefine Ein and Eout as just different directions of transferred energy Etransferred, then we have E=Etransferred where Etransferred is positive if energy comes into the system and negative if energy is leaving the system. Now, we know that there are two different ways to transfer energy into or out of a system: heat Q and work W. Thus, Etransferred must be the sum of the energy transferred by heat and the energy transferred by work, Etransferred=Q+W. The statement of the law of conservation of energy can therefore be written as

Written in this form, the law of conservation of energy is called the *First Law of Thermodynamics*, i.e. the First Law of Thermodynamics and the Law of Conservation of Energy are the same thing.

This statement is so fundamental to the idea of physics that it is worth spending a minute to really unpack what it says. Looking again at the First Law of Thermodynamics (with the delta expanded) we see

where both heat Q and work W are ways of *transferring* energy into or out of the system. As a first example, say we have some system and we do work on that system without transferring any energy as heat. In this case, W>0 as energy is coming in and Q=0. The result is that Ef>Ei, which makes sense as we have added energy. Similarly, if we had a system that is losing heat to its environment while remaining stationary at constant volume then we know that Q<0 because heat is flowing out and W=0 due to the fact that there is no “distance” for W=Fdcosθ. Therefore, Q+W<0 and Ef<Ei as expected given that energy is flowing out of the system.