

12 The energy conservation law

Subject:

The formulation of the energy conservation law does not seem to be trivial. The quotations (1) and (2) are taken from school books, and quotation (3) is from a university book.

(1) “The total energy of a body can be distributed among different forms of energy. – Without the transfer of energy to or from other bodies the total energy of the body remains constant”... “If several bodies are involved in the exchange and transformation without friction being present, the sum of kinetic, elastic and gravitational energy remains constant.” ... “If friction is taken into account, the internal energy of the bodies and of the environment are part of the energy sum.”

(2) “Theorem of the conservation of mechanical energy: In an energetically isolated system the sum of the mechanical energies remains constant, as long as the mechanical phenomena take place without friction. Energy is never lost, nor does new energy come into existence; it transforms from one mechanical form into another.... According to this theorem there exists a state variable for an energetically isolated system, called mechanical energy, which can appear in different forms, whose value is always conserved. Therefore, the energy of such a system is a conserved physical quantity.”

(3) “Now the energy law can be formulated as follows: The amount of heat ΔQ supplied to a system from the outside serves to increase its internal energy ΔU , e.g. its temperature... or its electrical or chemical energy, and serves to realize the work ΔW , which we will consider negative when it is delivered by the system, so that

$$\Delta U = \Delta Q + \Delta W.”$$

Deficiencies:

A simple fact is described in such a way that it is hardly possible to recognize its simplicity. One might argue that before formulating the energy theorem, much has to be taken in consideration. However, one should eventually pronounce it in all clarity: Energy cannot be produced or destroyed. And there should be no qualms with this sentence. Otherwise the idea unavoidably comes up that conservation itself is a difficult concept.

Origin:

See the article “isolated systems”.

Disposal:

Formulate energy conservation in the same way as the conservation of electric charge, i.e. without any ifs or buts, for instance as follows: Energy can neither be created nor destroyed.