

Historical burdens on physics

1 Forms of energy

Subject:

It is common knowledge that energy exists in various forms. Kinetic, potential, electric, chemical energy and heat are examples known to everybody; “converting energy from one form into another” is a common way of speaking.

Deficiencies:

Although we often speak about energy forms, we run into difficulties as soon as we try to define them. We are not consistent in the necessary distinction between the forms of stored and transmitted energy. On the contrary, in our casual formulations we tend not to differentiate the two concepts. While for heat and different types of work certain rules have been established, the classification of storage forms of energy seems vague and arbitrary, with the exception of some mechanical textbook examples. Which part of the energy of a steel spring or of an air molecule is mechanical, thermal, chemical, electric or magnetic? Which part is translational, rotational, oscillatory or electronic? Which part is kinetic or potential? Which part is ordered or unordered? The fact that we obtain reasonable results without knowing the answers to these questions leads to the conclusion that the classification is of no importance for our physical arguments.

Origin:

In order to account for the role of energy within the network of physical phenomena, enumerating energy forms is a means of expression which is difficult to avoid. This can be seen in a citation of *F. Mohr* (1837) from the time before the discovery of the conservation of energy: “In addition to the 54 known chemical elements there exists in nature yet another agent, the name of which is Force: Under appropriate circumstances, it appears as movement, chemical affinity, cohesion, electricity, light, heat and magnetism, and from each of these forms of appearance, all of the others can be brought into being.”

Disposal:

We save many words if we refrain from useless differentiations. It is often comfortable to speak about bottle milk and carton milk. It is completely useless, however, to call the process of transferring or drinking it “milk conversion,” or to define the content of a glass or of the stomach as different “forms of milk.” The situation is the same when speaking about the energy. The clearest, but perhaps not the most comfortable solution is to refrain from speaking about energy forms completely. Of course, just as for a patient who after a long period of convalescence leaves his crutches for the first time, it takes time until one is acquainted to the newly acquired freedom and also to be able to cover difficult terrain.

Georg Job, University of Hamburg