

scientific point of view, the principal defect in this theory was, that its explanations could not be subjected to any strict and exact numerical verification. Whenever an element enters into our operations which has either no weight or a negative weight, and thus evades exact determination and control, explanations and observations become vague and uncertain.

In the time of Lavoisier, and pre-eminently through his exertions, this vague and unmeasurable principle phlogiston was eliminated from the laboratory and the text-books: quantities took the place of indefinable qualities, and numerical determinations increased in frequency and accuracy. The vague phlogistic theory, which contained a germ of truth, but one which at that time could not be put into definite terms, had helped to gather up many valuable facts and observations: these were collected and restated in a new and precise language. It has been said that every science must pass through three periods of development. The first is that of presentiment, or of faith; the second is that of sophistry; and the third is that of sober research. Liebig states the case somewhat

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Phlogistic
theory.

substances enter into chemical reaction; and the mobility or inertness of chemical substances was to be measured by the presence or absence of a definite something. A hundred and fifty years after Stahl, science had so far advanced, that besides the change of weight or mass, the change of the power of entering into chemical combination could also be measured, and the term "potential energy" was introduced to describe many of those properties and processes which Stahl had fastened upon, when he, as the pioneer, undertook to co-

ordinate chemical phenomena. If Stahl considered phlogiston to be a substance, though he did not inquire into its mass or ponderable property, the question might be put again, whether "energy" is not to be considered after all as a substance. Cf. Tait, 'Properties of Matter' (2nd ed., introduction, especially p. 5 *sqq.*); 'Recent Advances of Science,' introduction; also Clerk Maxwell, 'Electricity and Magnetism' (last chapter); Ostwald, 'Chemische Energie' (Leipzig, 1893, p. 41).