of a compound, energy may be evolved in other forms. It is well known that in order to change a liquid into gas, heat must be imparted to it, or, if the change take place by evaporating the liquid in a partial vacuum, the liquid itself will grow cold.

Conversely, when a gas is condensed into a liquid it parts with the energy which it previously contained. When a solid is changed into a liquid it absorbs energy; when a liquid is frozen into a solid it loses energy. Now, in many chemical reactions the products have not the same physical state as the substances from which they are formed; and in this case energy is lost or gained according to circumstances. For example, when carbon dioxide is set free by the action of an acid upon marble, a gas is produced, and the production of this gas is attended with absorption of energy; in order to measure the amount of this energy it would suffice to condense that gas to liquid and to freeze the liquid to solid and to measure the amount of energy evolved during these transformations. It would then be possible to ascertain the total quantity of energy lost during the chemical change, independently of the change of state which the products undergo on being formed. But this is not all; for when a gas is produced it occupies space and displaces a certain amount of air. Imagine the gas to be evolved at the bottom of a vertical tube, which, of course, was originally in communication with the atmosphere and full of air; the gas would expel this air from the tube, or, in other words, raise it. Now air possesses weight, and presses on the surface of the earth with a weight of 1.033 kilograms on each square centimeter, and the work done by the gas in issuing into the atmosphere would depend, in the instance given, on the sectional area of the tube, and the height up the tube to which the carbonic acid reached. Here energy is expended, or, as is usually said, work is done, in raising the weight; and in estimating the total energy of the reaction mentioned, this work, accomplished against gravity, must be subtracted from the total.