A FEW SUGGESTIONS ON THE TEACHING OF FUELS IN ELEMENTARY CHEMISTRY

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ABSTRACT

The usual study of the composition and source of ordinary fuels such as coal, coke, alcohols, gasoline, etc., is recommended. The study of heat values is practical chemistry applied to human needs and human progress. Emphasis is placed upon the teaching of quantitative relationships, although in doing so criticism may develop from the inability of the learner to include all factors in making conclusions. This may lead to partial and even misleading ideas. It is pointed out that the nature of the subject of chemistry is such that the use of pure mathematical methods has its limitations. The growth of ideas is necessarily slow. If, during the acquisition of fundamental concepts, wrong ideas for a time enter there should be no cause of worry. The growth of the individual in generalization is analagous to that of the race. With the limited knowledge of the race of fifty years ago it is perfectly natural that the learner should think as the learner of that time. The important thing is that the learner continue the ability to modify his general notions as he acquires new facts.

It is recommended that the pupil be led inductively through the development of such ideas that fuels with a large percentage of hydrogen by weight have high heat values. This may be developed by taking the heats of formation of carbon dioxide and water from standard publications and calculating in each case the calorific value per gram of these elements. The application of these facts to the estimation of heat values from percentage compositions is recommended. The effect of oxygen in fuels is easily taught.

Gaseous fuels are composed of a few simple units, by studying the heat values of which the learner is prepared to estimate the heat values of these fuels from their composition. An opportunity is offered in this study of reviewing such topics as the meaning of a formula, law of combining volumes, and the Avogadro principle. The idea that hydrocarbons are decomposed into elements, which burn as uncombined substances is noted. The law of heat summation is used as a matter of common sense without any attempt to formulate the law in terms of mathematical symbols.

The oxygen required for the combustion of fuels is studied in relationship to heat values. Equations are written showing that for the combustion of one atomic weight of carbon (twelve grams) one volume of oxygen is needed, while for the combustion of an equal weight of hydrogen three volumes of oxygen are needed. Numerous equations involving the combustion of various elementary units of which fuels are composed are recommended as project work. Attention is called to the oxygen needed for combustion and the luminosity of flames.

Attention is called to the need of teacher explanations that such studies are more or less idealistic to the extent that because a fuel has a high heat potential is no sure indication that it is being realized in practice. The efficiencies of heaters and calorimeters are compared. Calculation furnishes the goal to be attained in future methods of manufacture; it should encourage invention.