Chem Ed

EDITORIALLY SPEAKING

Does the scientist have consistent and different meanings for the terms "law" and "theory"? We doubt that extensive reading in the philosophy of science would be needed for a practicing scientist to answer that question. The surprising circumstance is that students reading the opening chapter in various introductory chemistry textbooks will get different impressions from different books. Our long-standing inclination to comment on this has been crystallized into resolve by the receipt of a letter from Professor W. R. Carmody of Seattle University. He writes:

"Some of the members of our chemistry department have been somewhat perturbed by what appears to be a growing tendency among writers of textbooks to define the term (scientific or natural) "law" in a fashion that departs radically from the traditional meaning of the word that has been used and generally accepted for hundreds of years. Alexander Smith states it simply in the second edition of his famous text: "A Law or generalization in chemistry is a brief statement describing some general factor or constant mode of behavior." A more recent text indicates not only what a law is but also what it is not: "A scientific law is a convenient summary of what happens, is not in any sense an explanation."

Professor Carmody goes on to deplore the contrast represented by the following statements from other books:

"If the theory stands the test of time, that is if it proves to be in accord with further observational testing of the consequences that can be deduced from it, it is finally called a law."

"If proof finally is adduced for a theory, from it there may arise a new law."

To these we add another which we feel is likely to leave the same misunderstanding.

"We no longer refer to Lavoisier's proposal as a theory, it has become a law . . . . The generalizations which are designated as laws are so very well established that we think it most unlikely that any of them will be upset."

And from a widely used high school text . . .

". . . when enough conclusive data becomes available to prove that the theory is true, it may be restated as a law."

We hardly think that this circumstance is a calamity, but we do feel that clarifying it is more than an exercise in hair-splitting semantics. Teachers (and authors!) should be more careful. If an author is going to give his readers definitions (often with italics) and if he departs from the generally accepted form, he should indicate why he feels he should make such a departure.

We feel that some clarification comes from realizing the way in which laws (generalized observations of a particular kind) and theories (relationships of diversified observations, interpretations, postulated models—the broadest kind of "explanation") stand the test of time and new knowledge. A law can be untrue only if the data are incorrect or the mathematics incorrectly applied. Boyle's law is not abandoned because gases can condense to liquids. Rather, new observations in a sense build a fence around the territory where the $P \times V$ = constant can still be considered the "law of the land."

In contrast, a theory, being a man-invented model of nature rather than a faithfully recorded observation of nature, may well meet a more grim fate. Science, unabashedly pragmatic in its view toward any "explanation," can discard an unsuccessful theory, yet never offers more than tentative acceptance to a successful one.

The essential humility with which modern science views nature does not use words like "finally," "prove," or even "true" without qualification. We should not forget that our students are studying to be modern scientists.

The cover

We mean no more irreverence for the concepts implicit in a conformational representation of fused cyclohexane rings (see page 278) than did Kekule's contemporaries for his benzene structure (see page 266). We thank Miss Lynne D. Cherry, junior chemistry major at The College of Wooster, for her present-day coalescence of zoology with chemistry to complement that of Herr Findig in 1886.