something new from the past

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Topics:

Oxidation Reduction
Electrochemistry

"Redox Revisited," Karl L. Lockwood, J. CHEM. EDUC., **38** [6], 326–329 (1961).

The admonition by Lockwood in this 1961 article is still appropriate for the 1980's. "Teaching oxidation-reduction may develop a great deal of unnecessary confusion in minds of students if clear distinctions are not made between the concepts of *stoichiometry* and *mechanism*, as well as between *valence* and *oxidation state*. Recognizing that there are several approaches to the teaching of balancing complex redox equations, the teacher is urged to keep in mind that whichever method is chosen, it is essentially an algebraic process, " . . . and that one method is as good as another." To emphasize his point, Lockwood suggests that " . . . perhaps several methods ought to be taught to the student to encourage him to think his own way through several, thus to see that the process is purely a mechanical one."

A set of seven rules are presented for calculating oxidation states and then are applied. Next, suggestion steps are given for balancing oxidation-reduction equations with a good selection of examples.

"Writing Oxidation-Reduction Equations," A review of textbook Methods. Richard G. Yalman, J. CHEM. EDUC., **36** [5], 215–218 (1959).

Starting with Linus Pauling's statement, *"Be sure that you know what the reactants are and what the products are,"* Yalman analyzes most of the textbooks in use up to the time of his writing. Yalman examined the texts for the following topics:

1) General Advice to the Student
2) Definition of a Chemical Change
3) Definition and Assignment of Oxidation States
4) Definition of Oxidation
5) Methods of Writing Equations
6) Hydrogen and Oxygen Balance

For the teacher who would like to have a quick review of oxidation-reduction concepts, this article serves such a purpose.

"Algebra For Balancing Redox Reactions," Harold W. Ferguson, *Chemistry*, **40** [2], 18–20 (1967).

Ferguson's article describes one approach and serves here as an example for the teacher to use. Ferguson ends his paper with problems to be done and gives their detailed solutions.

"A Chemical Christmas Tree," J. Richard Toler, *Chemistry*, **47** [11], 25–26 (1974).

This demonstration and variations of it have appeared many times in the journals. Laboratory investigations have been written for beginning chemistry students involving the stoichiometry of the reaction (CHEM Study Experiments 7 and 8, W. H. Freeman and Co. San Francisco, 1960). This article gives complete details for producing a Silver Christmas Tree for next December.

Refer also to this feature column that appeared in the October 1980 issue of this journal for other references related to the Silver Christmas Tree.

"Oxidation State Determinations for Some Reduction Products of Vanadiums(V), A Multi-colored Titration," F. C. Hentz, Jr., G. G. Long, J. CHEM. EDUC., **55** [1], 55–56 (1978).

Of all of the articles found on this most interesting colorful oxidation-reduction reaction, Hentz and Long give the most complete directions on how to do it. They refer to the CHEM Study film, "Vanadium-A Transition Element," (Brasted, R.C., Modern Learning Aids.) Their procedure allows ". . . the student to observe the four oxidation states of vanadium obtainable in aqueous solution . . . ." It can be done both as a demonstration or a laboratory experiment investigated by students themselves.

As an interesting follow up to the experiment, the teacher should read and use "Vanadium in the Living World," N. M. Senozan, J. CHEM. EDUC., **51** [8], 503–505 (1974).

Senozan, in addition to citing the presence of *hemovanadin* as a respiratory pigment in the corpuscles of certain living animals, gives examples of other transition elements needed as respiratory pigments of other living animals.

"When Your Car Rusts Out," Ward Knockemus, J. CHEM. EDUC., **49** [1], 29 (1972).

Corrosion of metals is by far one of the most insidious economic problems we face today. The author uses this problem for illustrating the principle of electrochemistry. He shows, in theory, the tendency for different areas of metal to be anodic or cathodic employing the Nernst equation.

"The Midas Touch," Floyd Sturtevant, *The Science Teacher*, October 1974, pp. 42–45.

Here is an activity that has great appeal in that it can produce jewelry items such as pins, earrings, or pendants and also can serve to give data for equivalent weight, oxidation number of the copper ion, and Avogadro's number using Faraday's Law. In other words, in addition to teaching the principles of chemistry involved, it has take-home value.

The procedure involves the electrodeposition of copper and/or nickel on plant leaves. Sturtevant gives ample directions for the procedure. Other "natural products" such as dried insects can be plated also. Indeed this appears to be a highly motivating activity for courses in beginning chemistry.

"Another Mnemonic for Oxidation-Reduction," Virginia Levin, *The Science Teacher*, April (1974), p. 47.

1) LEO the lion says GER
   *L*oss of *E*lectrons is *O*xidation
   *G*ain of *E*lectrons is *R*eduction
2) R-C cOlA
   *R*eduction at the *C*athode
   *O*xidation at the *A*node

In the same issue, same page, Julius Dereo outlines two procedures that have practical application and involve oxidation-reduction.

1) Percentage of H_2O_2 in drugstore hydrogen peroxide.
2) Analysis of Vitamin C (Ascorbic Acid) in citrus juice.
   The procedure involves the oxidation of vitamin C by iodine to an end point using starch indicator to absorb the unreacted iodine.

This feature includes annotations of articles from previous issues of the JOURNAL, and other science teaching journals. Topics will be presented in the issue prior to when the topic is taught in a typical high school curriculum.

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