

## CHEMISTRY AND EFFICIENCY.

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In proportion as the word and idea of "efficiency" have become household possessions, so to speak, in educational circles, they are defeating their own aims. We are doing this generation small favor in teaching them to understand that efficiency is all-important and all-sufficient. Even though broad-gauged educators do not mean it to be so construed, that is the idea that will stick in the shallow mind of the average patron of our educational system. It has been a pleasure to note the recent appeals for a saner foundation for education than mere superficial efficiency.

Take the subject of chemistry for example. People with more zeal than understanding of the subject have insisted on making it practical from the very start; that is, even high school chemistry must be taught so that the boy and girl may go out into life with practical ideas for future use. It is unnecessary to say that the teacher who follows out the suggestion and dabbles in a course of elementary technology can not lay a thoroughly scientific foundation for the subject. The laboratory work becomes a blind following out of prescriptions with no adequate conception of the reasons underlying. The practical results which such a pupil takes with him into life will consist of a series of rule-of-thumb processes without the scientific foundations necessary for reasoning out causes, interrelations and consequences. If his memory slips up on him as to whether oxalic acid or soda was to be used, whether he is to use caustic potash or concentrated sulphuric acid, in testing the presence or absence of wool in a piece of cloth, he is without recourse—he hasn't the scientific foundations necessary for independent deductions.

The practical year of high school chemistry defeats its own aim:

*First*, in that it does not prepare for life—inasmuch as the learning of a few chemical names or the parrot-like repetition of a few prescriptions is not practical chemistry. Much more would the end sought be gained if the year were spent in laying the necessary stress on a thorough knowledge of the foundation principles, with only now and then an incidental reference to the practical application of the subject.

The foundation should consist in a thorough understanding of and drill in the following subjects—chemical and physical change; atomic and molecular weights as a foundation for stoichiometrical problems; the laws of definite and multiple proportions; the gas laws, especially Boyle's and Charles'; acids, bases and salts; oxidation and reduction; valence with a most thorough drill in writing structural formulas with a view to representing intelligently by equations what takes place in a reaction. A discussion of the modern theory of solutions and osmotic pressure, ionization and electrolysis is both important and interesting. With this as a skeleton, a sound and scientific year of chemistry can be built. It is not enough to go over these different subjects once, they must be repeated and reiterated until they become second nature, if they are going to bear fruit in scientific thought and reasoning. Every one of these fundamentals should be impressed by stoichiometrical problems. A student who cannot solve such problems in demonstration of the principles involved has not mastered the subject matter.

A student who has gone through such a course under skillful guidance is by no means as yet a chemist, but he is an intelligent tyro who can go out into life and understand the meaning of simple, everyday, chemical terms that confront him. Should he wish to know the reason for a set of facts that he does not understand, he has enough foundation so that he can read intelligently a not too technical discussion on the subject.

The difference between the products of the two systems of training is this: Anyone may keep his finger on a prescription and pour when it says to pour and filter when it says filter, but it takes real fundamental chemical knowledge to know why you pour, what you get when you add a precipitant, and why you filter.

*In the second place*, such a course does not prepare for future study. Too many teachers of college and university freshmen have had sad experience with these practically trained chemists. College teachers have been heard to say that they wish chemistry were not offered as a college prerequisite; students would then, at any rate, enter the freshman class free from predilections on the subject. As it is, they are utterly unfit for the sophomore course in qualitative analysis; they resent being compelled to take the freshman work together with others who have not had chemistry before; therefore, they either do not take it up or they are at a decided handicap in the prejudice which rankles in their

breasts if the subject is compulsory. They do not understand their own dilemma. They do not know wherein their deficiency lies nor that they have one. They know a few names, can ask for the  $H_2O$  and the  $NaCl$  at table, and consequently do not need to spend two hours a day in preparation for the recitation. Before they realize it, the foundation discussions are passed and they are floundering about, aimlessly snatching at a name here, a formula there, that happens to have a familiar sound, but the real essence of the subject, the foundation upon which to build advanced study, has eluded them.

My contention is simply this: In an attempt to make chemistry intensely practical, we destroy the very properties for which it has been cultivated as an educational subject. It degenerates into empiricism and is not scientific. Like alchemy of old, it desires to touch nature's raw materials with the philosopher's stone and convert them into useful and practical goods—it becomes a course in imitation, not in independence of thought and action. It trains the pupil to be dependent and helpless instead of making him able to rely on his own knowledge and judgment.

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#### POTASH IN LAKE MUDS OF WESTERN UTAH.

Potash in surprisingly large proportions is present in the brines and muds of the Salduro Marsh, a sink in the Salt Lake Desert, about sixty miles west of the southwest edge of Great Salt Lake. From the clays underlying the salt body which covers the marsh, the U. S. Geological Survey collected samples at depths of eight to twelve feet, in which the dissolved salts were found to contain from two to about  $3\frac{1}{2}$  per cent of potash, and  $2\frac{1}{4}$  per cent was found in the soluble salts at a depth of about four feet. Of the dissolved salts contained in the brines occupying the spaces between the salt crystals in the crust overlying these muds, three to four per cent was found to be potash.

Singularly enough, the salt crust left at the surface of the desert through the evaporation of the brines contains little more than a trace of potash, most of the potash being confined to the brines and to the muds underlying the salt crust. The successful extraction of this potash is a fascinating as well as most pressing problem for the chemical engineer. According to analyses made by the Survey, the brines and muds from the Salduro Marsh contain considerable magnesium chloride, as well as chlorides of potassium and sodium, and so are somewhat similar in composition to the deposits from which potash is manufactured in Germany. Therefore, it appears that success in methods for manufacturing potash at the Salduro Marsh should prove comparatively easy. While no extensive exploratory work has been done by the Survey to show the area of the deposit, it is believed that the amount of potash present in the region, if it can be extracted with commercial success, is sufficient to provide a valuable source of supply to the country.