

educationally it is an excellent subject for securing closeness of observation, accuracy of reasoning, clearness of judgment and exactness of expression. The attraction that the study has for most pupils of secondary school age is easily accounted for by the opportunity it affords to solve problems by experiment, and by the easily observed phenomena that accompany chemical activity. The quantitative character of the reactions, and the fixed laws that govern chemical change, enable the teacher to take advantage of this partiality for the subject to secure valuable educational results, especially when pupils are at the age at which they are just passing beyond the stage of thinking in terms of the concrete.

It is assumed in this book that pupils have taken the Lower School Physics; and work that would be a repetition of that formerly done has been omitted. It is also taken for granted that there will be an instructor competent to direct the study, to drill on important points, to put stress where it is required, and to fill in details which he may think necessary. A text-book is of value as a guide to the work, as economising time for both master and students by system and condensation; but it is not a treatise embodying all that is known of the subject. It can not, in any sense, replace the teacher, because it is without personality, it can inspire no enthusiasm, and it lacks all emphasis. The experiments in the Manual are generally suitable for students' practice; but the varying facilities for this work in different schools will doubtless lead to some of the experiments being done by the teacher or by pupils under his direction. For this purpose the selections will not be the same in all cases, so the choice has been left with the teachers concerned. The text-book assumes these experiments to have been completed, and the observations recorded. The results are briefly discussed, their relationships pointed out, and necessary information supplied. The practical work done by the student must be constantly supervised by the teacher, because the value of an experiment does not lie in the noise and flare that it produces, but in what the student gets out of it that he can apply to the problem he is solving or to the investigation he is making.

The following principles should be observed regarding experimental work in class:

1. There should be no random work; every experiment should be undertaken for one definite purpose, *and only one*, and the student should know what problem he is seeking to solve, and what he is to note among the results observed. For this purpose, he should receive directions in the form of questions or hints. Further, it is all important that the experimenter should rely entirely on his observations, and that he should not discount his own work by having his mind made up regarding what should occur.

2. The accurate use of language should be rigidly insisted on to express exactly what is intended, neither more, nor less, nor anything else. Slovenly expression is no more to be tolerated than slovenly work.

3. Whatever tends to divert attention from the one thing sought should be avoided. All diffusion of either thought or effort is wasteful and injurious. If a second result of an experiment is wanted for