tion", published by Scott, Foresman and Company, and Ruchs & Stoddard, "Tests and Measurements in High School Testing" published by The World Book Co.

Third. Join the Iowa State Teachers Association and attend the General Science sections of the state and sectional meetings. Let the leaders of these meetings know in advance what type of work you wish discussed, and contribute whenever possible to these meetings. Get acquainted with leaders of General Science in your section and talk over your problems.

Fourth. Visit classes in higher institutions as well as classes in secondary schools that offer work similar to yours. Study their methods, texts and courses of study. Then carry home with you and use any good ideas gleaned from your visit.

Fifth. Go back to college as often as possible. Keep your mind open to the changes in the field of General Science and come to accept them as a basis for adjustment and guidance.

Under the supervision of the State Department of Public Instruction a committee is now working on a Course of Study for General Science for the Secondary Schools. The formulation of such a course for the adolescent youth is a difficult task but it is the hope of the committee that the course will attain its aims, that the subject matter selected will appeal to the pupils, that the training and knowledge involved will be usable and worth while, that the content will be organized for teaching situations and that the suggested methods of presentation will conform to the best modern practices. When this course is placed in the hands of all of the teachers it should be valuable in unifying the work of General Science in the state.

WINIFRED GILBERT

A correspondent reminds us that some teachers of science leave the impression in the class that our present knowledge of science was given to the world ready made or grew out of the presses that printed the text. The moral is obvious: don't neglect the historical phases of your subject. In a future issue we will list "anniversaries in science" with references that can be found in the average high school library.

WHAT ARE WE TEACHING IN BIOLOGY?

Biology

This subject in order to be of real value must be an actual study of plants and animals. I have observed in my teaching that pupils, when given recognition characters of trees, may be able to pass a satisfactory examination on these characters, but fail to recognize the trees they describe when they see them in the field. They have simply memorized words that mean nothing to them. Children have a natural interest in the living world, but they often lose it before they finish high school. We begin by teaching from books early in the grades and continue this through the high school, so that by the time the pupils reach the college, they are saturated with textbook knowledge. The story is told of the learned men who had the perplexing question to answer, "How many teeth has a horse?" They debated the question at length. They consulted the writings of Plato, Aristotle, and other great scholars, but failed to find the answer. At last, they concluded that the question could not be answered. A young man who had been listening to the discussion timidly suggested that they might be able to answer the question if they would look in the mouth of a horse. I find that many college students try to answer all questions as did the learned men. They believe that all worth-while knowledge is contained within the covers of a book, yet round about them lies a world full of interest if they but knew how to study it. We fail to teach our boys and girls how to observe and how to draw conclusions from their observations.

One of the principal values of biology in high school is the opportunity it offers for the study of concrete materials. The only way to know birds is to study them in the field. The only way to become acquainted with trees is by observing trees. Textbooks are useful for reference, but the pupil should be led to draw his conclusions from observations of concrete material. He should be conscious that he is studying a plant or an animal rather than five pages of a textbook or the "fifth exercise". There is an abundance of material for the study of living things and no elaborate laboratory equipment is necessary. However, unless the teacher really knows his out-of-doors, his biology teaching must degenerate into mere textbook memory work.

I would prefer that the student who enters college should have some knowledge of the out-door world and the ability to draw conclusions from his observations than that he should be able to pass a superior examination on a biology textbook. This type of interest and knowledge is a most valuable training for life and is far superior to knowledge gained from a textbook. Are we teaching living plants and animals or are we teaching textbooks?

C. W. LANTZ

LABORATORY EQUIPMENT AND EXPERIMENTS FOR DETERMINATIONS OF DENSITY

Physics

Laboratory experiments in Density require the following apparatus: beam balances, meter sticks, graduates, calipers, tumblers, test tubes, and hydrometers. There should be as many of each as possible in order to reduce the amount of group work. The objects for study should include pieces of lead, zinc, marble, paraffin, beeswax, glass stoppers, shot, gasoline and solutions of salts such as blue vitriol. The solids listed above should not exceed one cubic inch in volume if tumblers are used for liquid immersion.

Before beginning the laboratory work, it is advisable to have the pupil perform a few preliminary exercises which can give him practice in the metric units of measurement. At this college, the first exercise is the measurement of the length and breadth of one of the laboratory tables, using the meter stick. The dimensions are first measured in centimeters and then in inches and ratios of the breadth to the length then computed in each case. The ratios obtained by the class should be approximately equal, depending upon the accuracy of the work. A second exercise calls for the volume of a tumbler, measured with a graduate and also by the method of weighing. This gives the pupil practice with the beam balance and the metric units of weight and volume.

Having done this preliminary work, the pupil is now ready to begin his study of density. Logically, the first problem should be a test of the validity of the buoyancy idea of Archimedes' Principle. For this we have always used short solid brass cylinders about three centimeters long and one centimeter in diameter, which can readily be cut from brass rods found in a plumber's shop. The dimensions of the cylinder are measured accurately by means of calipers and the volume calculated. After this is done the cylinder is weighed in air and again immersed in water. The difference between these weights completes the data for the problem.

Following the problem on Archimedes' Principle, it is customary to begin the actual work in density determinations by the use of some regular solid. Rectangular blocks of hard wood, as hard maple, with accurately mitred edges serve excellently. The length of the blocks should be about five centimeters, with breadth and thickness varying from two to three centimeters.

The laboratory problems should cover density determinations of insoluble solids heavier than water, and lighter than water; also of common liquids, like gasoline and salt solutions, using the bottle and constant volume methods. Test tubes with fine shot can be used for the constant volume method. If time permits, the brighter students may be assigned a problem in the density of a solid soluble in water, such as crystal of blue vitriol, using gasoline for immersion. They may also make a rough determination of the density of the air in the room.

All problems mentioned above are described in current laboratory manuals for high school physics. All of the laboratory problems used in this college for student practice are outlined in a mimeographed pamphlet which is sold at twenty-five cents, the actual cost of printing. Readers can secure copies at this price through the Editor of the Science Bulletin. We prefer to use regular laboratory manuals for refernce only.

L. BEGEMAN