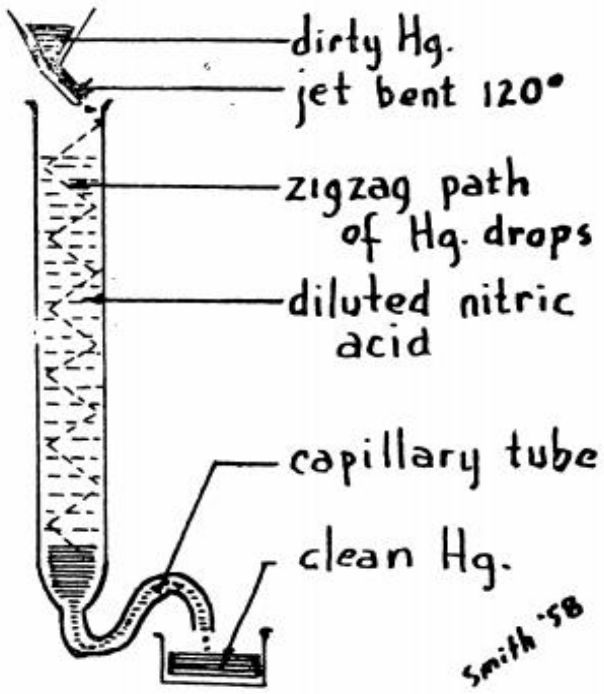
Understanding Science Laboratory

By Jack Smith

POPULARIZING science subjects or courses in Philippine schools will need a sizable number of equipment and apparatus. Although some of these can be improvised or made in the school shops, many will have to be purchased, not to mention the supplies and materials needed from time to time. It can be perceived, at once, how costly it is to maintain and operate a science laboratory. And then, to think that the laboratory could become a veritable playground for the prankster would add to the headache of the science teacher. It is imperative, therefore, that discipline, despite the trend for freedom in classroom activities, should be maintained in the laboratory. Batteries can be grounded and consumed uselessly; resistance wires, burned; meterstick, thermometers, and tubes, broken; and gas, chemicals, and water, drained.



Electrical experiments should be supervised, if not checked by the teacher, before actual experimentation is done. Test tubes with broken bottoms should be reformed and resealed by heating.

The teacher can apprised his students as to the prices of articles, show them how to recover residues and useful substances, and mark "notices of care and caution" to materials and supplies which are expensive to be able to impart the economic use of these things.

For a smooth and efficient organization of laboratory work, the teacher's task, among other things, would be that of discipline, cleanliness, and economical use of supplies. There shall be no delegation of responsibility or authority except to one whom he can depend upon. Otherwise, he should group the students under capable and intelligent leaders. Understandable and thorough instruction should be given before performing the experiments. The instruction, to be more effective, should be given when everybody is at their most attentive state and that all noises within the room are silenced. Apparatus and working space should be arranged as to prevent loafing and chatting: in short, make everybody busy.

Delicate instruments and apparatus need special care and attention. The analytic balance, for example should be kept away from corrosive fumes and chemicals; its knife-edge fulcrum should not be dulled through unnecessary jarring; its fractional foil weights stored properly; and its pan, cleansed, polished, and lacquered. The balance may be adjusted from time to time. Another costly instruments are the various kinds of electric meters. The teacher should be able to instruct his students what to do in order to take good care of these instruments.

Cleanliness and proper "housekeeping" of the laboratory should always be observed before, during, and after every experiment. After use, the bench top should be cleared of bottles, papers, etc.; all chemicals and apparatuses, stored in their correct places. Glass tubes, mortars and pestles, and other such accessories should be washed and cleaned before turning them over to the storage room. A most inexpensive powder for cleaning is the wooden fuel ash or powdered charcoal.

The habit of cleaning the sink every time after its use should be instilled in the minds of the students. A good aid for the formation of such habit is the wooden wastebox being provided near the sink. Concentrated acid should not be poured in the sink with-

out wetting the sink first. Clogged drainpipe should be immediately attended to, otherwise, more troubles will arise.

Assorted sizes of bottles, preferably of the same type, should be used and their contents labeled, either printed or scribed legibly with India ink. To prevent effacing of identifying label, it can be coated with paraffin wax or paper varnish made by mixing 20 grams of celluloid (like the old photo film) and 30 c.c. amyl acetate or acetone. Label marks can be preserved if the label is placed against the palm when pouring out the chemical. (The versatility and experience of the laboratory technician is oftentimes gauged through the way he handles the bottle when pouring!)

Some important points to remember about storing are these: Put all similar articles, like beakers or test tubes, in one place; likewise, each apparatus should have its own definite place. The students may be rotated in groups to see that these points are carried to the letter. Other responsibilities are the custody of cupboards and drawers and their contents. These, like the shelves and bottles, should be identified for proper placement of articles.

The shelves, if not well protected from corrosive effects of chemicals, like the bench top, will soon deteriorate. Teakwood or wood with natural oil is good for laboratory shelves and table tops. Otherwise, the wood can be coated with paraffin wax prepared by mixing one part wax to five parts, gasoline or 100 grams wax with 30 grams beeswax in 400 c.c. gasoline. Benzine or xylol can be used instead of gasoline. The solution while hot, should be applied to the wood with a piece of cloth or brush and then, polished dry. Even if wood with natural oil is used, waxing is still recommended to lengthen its life. Wax, for this kind of wood, can be prepared like the floorwax or simply use linseed oil and turpentine in equal volume.

Laboratory discipline can also be maintained by using wisely the supplies and materials. The habit of economizing and recovering chemicals will not only improve the students sense of propriety but also enable him to know more effectively the process of recovery. For example, the recovery of waste iodine. This can be purified and recovered through filtration and sublimation. In silver salt solution, silver is recovered by using hydrochloric acid; thence, titration, filtration, reduction, etc. Mercury can be recovered through distillation but the one being illustrated is handy and inexpensive. The dirty mercury is funneled through a 120°-bent tube by drops. Each drop bounces down along the wall of the long tube filled with diluted nitric acid, about 1.5 normal. It settles at the bottom and passes out through the capillary tube, already cleansed and recovered. The science teacher can teach his students the many useful ways of recovering

chemicals. Polluted alcohol and benzene residues, for example, can be recovered through distillation.

Proper knowledge of material composition and purchasing, installation, and use of supplies and materials can promote orderliness in the laboratory. Let us illustrate this point briefly.

Cork is of two varieties: the natural (solid) and the cheap one which is granulated and bonded cork.

It would be wasteful to bore the latter as it will give way easily. It can only be used as stopper. Porous cork can be made airtight by soaking it in molten wax or vaseline in benzene. The natural cork should be bored two ways and the hole enlarged by a small round file.

Rubber stoppers, when purchased, should have no bored holes. Boring can be easily done by wetting the borer to lessen friction. Water, vaseline, or glycerine can be used to wet the borer.

The crucible is of three kinds: porcelain, metallic, and silica. The nickel crucible is much cheaper than the platinum one but it can not be used with fusible metals or compounds and chlorides. Silica crucible is easily attacked by alkalies and lead salts. For general purpose, use nickel, not iron, crucible tong. The idea behind this information is to let the students develop an analytical mind especially in the proper use of utensils.

Permanent fixtures, like gas and water outlets, should be of gun metal (phosphur bronze, of copper and tin composition) as this will not corrode easily. Metallic articles, especially those made of steel like the retort stands and tripods, should be painted periodically to prevent rust formation.

Mortals and pestles are of various kinds, i.e., porcelain (glazed and unglazed), iron or steel, or agate, and each kind having definite use and advantage over the others.

A well-equipped laboratory has the Centigrade and Fahrenheit thermometers, up to 100°C, 400°C, 212°F, and 232°F, and even with the 1/10° readings. The students should be taught how to use and care for thermometers.

The barometer should be hung vertical and plumb about 5' from the floor, illuminated for easy reading, and in a place where the temperature is not affected by unnatural means.

To prevent extreme agitation when evaporating liquid by boiling, porous substances like pieces of broken pot or earthenware and charcoal can be placed in the liquid while cold. Whatever these substances are, they should not react with the liquid.

A laboratory teacher, like the seasoned technician, should be a handy man and trouble-shooter in order that he can be respected, obeyed, and admired. In this way, he can easily maintain discipline in the laboratory. For example, he should know how to remove a stuck-up or stubborn glass stopper. This he can do by tapping out lightly the stopper, heating uniformly the outer surface of the bottleneck to expand it, or dropping a penetrating oil (lube oil with little kerosene or gasoline) and heating the surface. To prevent the incidence of sticking up of stoppers, they should be greased first before restoring.