

**TESTING OF CHEMICALS AND SUPPLIES IN
TEXTILE MILLS AND DYEWORKS.**

(Continued from page 92.)

**LIST OF APPARATUS REQUIRED FOR
LABORATORY.**

GLASSWARE.	QUANTITY.
Beakers, 60 c.c., 120 c.c., 250 c.c., <i>Griffin form, with lip</i>	6 each.
Beakers, 350 c.c., 700 c.c., <i>Griffin form, with lip</i>	4 each.
Burettes, 50 c.c., <i>graduated in 0.2 c.c.</i>	4
Crucibles, porcelain, <i>with cover, 15 gram</i>	3
Dishes, evaporating, <i>porcelain, 120 c.c., 300 c.c.</i>	3 each.
Dishes, evaporating, <i>porcelain, 30 c.c., 60 c.c.</i>	6 each.
Dishes, evaporating, <i>porcelain, 600 c.c., 1000 c.c.</i>	1 each.
Flasks, <i>glass, Erlenmayer, 500 c.c.</i>	4
Flasks, <i>glass, Erlenmayer, 120 c.c., 250 c.c.</i>	6 each.
Flasks, <i>glass, Florence, 500 c.c., 1000 c.c.</i>	2 each.
Flasks, <i>graduated, 1 litre, 500 c.c.</i>	2 each.
Flasks, <i>graduated, 250 c.c., 100 c.c.</i>	2 each.
Funnels, <i>glass, 60 c.c., 250 c.c.</i>	4 each.
Glass rods, $\frac{1}{4}$ inch and $\frac{1}{8}$ inch	$\frac{1}{2}$ lb.
Glass tubing, $\frac{1}{4}$, $\frac{1}{8}$ and $\frac{1}{2}$ inch sizes	1 lb.
Measuring Jars, <i>graduated, 250 c.c., 500 c.c.</i>	1 each.
Measuring Jars, <i>graduated, 100 c.c., 50 c.c., 25 c.c.</i>	2 each.
Mortar and Pestle, <i>glass, small</i>	1
Pipettes, <i>graduated in 1 c.c., 5 c.c., 10 c.c.</i>	2 each.
Specific Gravity Bottle, 10 gram	1
Watch Glasses, 2 in., 3 in.	6 each.
Test Tubes, 6 in., 8 in., 4 in.	12 each.
Test Tubes, <i>with foot, 6 in.</i>	12
Bottles for Reagents, 4 oz.	Set 1.
(40 bottles in set, labelled as per catalogue.)	
Bottles, <i>glass stoppered, 1000 c.c.</i>	10
Bottles, <i>amber, round, 500 c.c.</i>	10
Bottles, <i>clear, cork stoppered, 1 quart and 1 pint, about</i>	12 each size.
Bottles, <i>cork stopper, 2 oz., 4 oz. and 8 oz. and 1 pint</i>	12 each.
Bottles, <i>glass stoppers, 4 oz. and 8 oz.</i>	12 each.
Other bottles as needed.	
MISCELLANEOUS.	QUANTITY.
Alcohol lamp, 4 oz. size	1
Bunsen burner, <i>gas, with rose top</i>	1 or 2.
Cork stoppers, <i>assorted for pints, quarts, etc., about</i>	4 doz. each size.
Cork borer, 3 in set	Set 1.
Apparatus stand, 3 rings	1
Burette stand, for 4 burettes	1

MISCELLANEOUS.	QUANTITY.
Stop-cocks, for burettes, wire.....	6
Scales, analytical, to weigh 1 mgm. to 10 gm.	1
Set of Weights, metric, 1 cg. to 10 gm.....	1
Platinum Crucible, 15 gm. size.....	1
Nickel Evaporating Dish, 30 c.c., 60 c.c.....	1 each.
Rubber Tubing, 1/8 in., 1/4 in.....	6 ft. each.
Rubber Stoppers, for pint bottles.....	36
Thermometer, chemical, Centigrade Scale....	1
Test-tube Rack, for 18.....	1
Test-tube Holders	2
Drying Oven, for gas or alcohol.....	1
Sand Bath, 6 in. diameter.....	1
Water Bath, 8 in., assorted lids.....	1
Funnel Rack, small size.....	1
Retort Stand, 12 in. high.....	1
Filter Paper, 3 in., 4 in., 6 in., best white....	1 pack, each.
Sieve, 6 inch, No. 80.....	1
Clay-pipe Triangles, 4 inch size	3
Copper Wire-gauze, heavy.....	1 sq. foot.
Sheet Iron or Copper, 4 in. sq., 1/8 in. thick.	3 pieces.
Copper Wire, light.....	3 feet.
Copper Foil, thin.....	6 sq. inches.
Magnifying Glass.....	1
Sheet Asbestos, 1/4 in. thick.....	1 sq. foot.
Scissors, File, Pinchers, Labels, etc.....	

The foregoing list of glassware and apparatus may be taken as furnishing practically all the articles that will be needed under ordinary circumstances. As the work to be done will be confined to what are known as analytical operations, the only things required are those necessary for measuring and weighing and the operations involved in testing. If desired, more of any of the items of "Glassware" may be ordered, as the list given is a minimum one, making allowance for breakage and for the requirements of several operations carried on at one time.

The number of burettes, measuring flasks and jars, and pipettes will not be found excessive, in fact more burettes may be needed if much work is done, and the other articles will be constantly used in volumetric analysis. A burette stand, or holder, is necessary. If expense is not a consideration, burettes with glass stopcocks are preferable to the plain style, as rubber tubing, which is affected by some test-solutions, is necessary with plain burettes.

A good set of scales is an absolute requirement, for on accurate weighing depends the accuracy of the test-solutions and all operations where the purity, strength, quantity, etc., of any article is being estimated. The scales must be capable of weighing one milligram with accuracy, in quantities weighed on it up to 10 grams. Such a "balance" as a set of scales for laboratory work is called, will be the most expensive part of the outfit, but the finer and more costly kind of balances is not required, and a good one can be bought for about \$35 to \$50. A set of weights in the metric system should be bought with the scales, a set containing weights from 1 centigram to 10 grams being most suitable. Small avoirdupois weights may also be bought if desired, but it will be found that the work can be done much easier if the metric system alone be used. Scales should be kept in a glass-enclosed case, which is supplied with them.

The best place for the balance is in the office, where neither fumes nor gases can reach it and destroy its sensitiveness and accuracy.

All apparatus used for measuring, *i. e.*, burettes, measuring jars and flasks, etc., must be accurate or they are worthless. Only those whose accuracy is guaranteed should be purchased, and it is best to test them before use.

Much of the expense of running a laboratory depends on the care taken in handling the apparatus, as the glass vessels used are necessarily very thin and break easily. Every article should be washed clean and carefully put away after it is used, and thin glassware should be kept on a shelf or in a cupboard out of the way. The following precautions are suggested for the care of glass apparatus and vessels, and in using chemicals.

Never set a hot beaker or flask on a cold surface.

Never expose a vessel containing a cold liquid to a direct flame; put the flask, dish or beaker on a piece of wire gauze or on a metal plate when heating it.

Never pour a boiling liquid into a cold vessel without setting this on a cloth or asbestos pad.

Never use the measuring flasks for boiling or heating liquids; make all solutions in common flasks or beakers and let them cool before pouring them into the graduated jars or flasks for measuring their volume.

Never expose crucibles or porcelain dishes to direct heat at first; heat them up gradually before applying the final intense heating.

Never use a large vessel when a smaller one would answer the purpose; large glass vessels break easier than small ones and cost more.

Never use large quantities of test-solutions when a little will be all that is necessary to make the test; don't waste chemicals needlessly.

Never make up larger quantities of test-solutions than will be required for the near future; many test-solutions lose strength when kept a long time.

If these rules are followed and if common sense and care be used, the running expenses of the laboratory will be found very small.

Bottles. Bottles of various sizes are a necessary part of the laboratory outfit, for keeping the test-solutions, etc. The chemicals, acids, etc., can be kept in the bottles they come in when bought from the dealer. Round bottles are the best, and bottles with glass stoppers must be used for all strong test-solutions, acids, etc. Cork stoppered bottles can be used for liquids that will not affect the cork, such as alcohol, glycerin, weak test-solutions, etc., but they must never be used for the strong test-solutions, acids or alkalies. The trouble with cork stoppers is that they absorb considerable liquid at times, and therefore an old cork

may contain enough of a chemical in its pores to spoil a test-solution if this cork be used in a new bottle holding it. Corks can be improved by boiling them in melted paraffin; acids and alkalis do not then affect them easily. Glass stoppers must fit snugly and accurately, but not too tight, else they will stick. If they be lightly covered with pure vaseline, rubbed over the ground part that fits in the bottle neck, before being put into the bottle, they will not stick or jam.

All bottles used must be clearly and plainly labelled to indicate exactly what they contain, never trust to memory or half-written labels. It is a good plan to keep a stock bottle for each solution and use it only for this particular one. Wash bottles well before using them. A neat way of rendering a paper label waterproof is to coat it thoroughly with hot melted paraffin, put on with a small brush after ink and paste are perfectly dry and wiping off the excess of paraffin with a cloth. A supply of gummed labels should be kept on hand.

There are a number of solutions of chemicals that will constantly be used in testing various substances, which are called reagents, and these are most conveniently kept in the so-called reagent bottles, which have glass stoppers and are lettered with raised glass letters on one side, giving the name and formula of the chemical solution in the bottle. A set of these comprises about forty bottles, each labelled separately, and may be procured by simply ordering thus: "1 set of reagent bottles." The set comprises the names of all the chemicals that will be ordinarily used. Solutions of other chemicals needed may be made and kept in suitably labelled glass stoppered bottles.

The standard volumetric test solutions are best kept in pint or quart amber, glass-stoppered bottles, using quart size only for solutions used in quantities. Many of the weaker solutions may be kept in cork-stoppered amber bottles, but good corks only can be used, and these should be first boiled in paraffin to fill up their pores and to prevent the liquids from affecting them.

Chemicals Required. To assist the student in fitting up his laboratory with the least expense for supplies, a list of the chemicals that will be required for the work later described is here given, with the approximate quantities of each article sufficient to begin with. While this list may not include everything that might be needed in the course of work, after this has been carried on for a while the student will be able himself to see if he needs other things. The purpose of this series of articles is to instruct the reader in the practical work of testing chemicals, dyes, mill supplies, etc., by giving only practical methods and their application, no instruction in general chemistry will be given except in so far as may be necessary to explain the theory and practice of chemical analysis applied to the purpose named, therefore, only the apparatus and chemicals needed for this work will be mentioned. However, much experimental work and general chemical analysis could be done with the outfit named, if so desired.

A few words before quoting the list of supplies are required. When ordering chemicals, specify only

one quality, *i. e.*, "chemical reagents of guaranteed quality," and insist on getting it. It will not pay to buy the cheap chemicals ordinarily used in industrial processes nor those found in the average drug store, they are too uncertain in strength and purity to be fit to use for analytical work, without being themselves tested, and this would be a long and tiresome job. The only chemicals fit for use in testing are those of the highest purity, so that solutions made from them can be depended on, as being exactly what they should be. This is especially true as to acids, which are hard to get strictly pure. If cheap chemicals are bought, they must first be tested and then purified before they can be used, and this will cost far more in time, labor and materials than will reagents of the highest quality.

The various chemicals bought should be ordered in glass bottles, holding the quantities mentioned in the list, acids and strong alkalis in glass stoppered bottles, chemicals affected by light in amber glass bottles. When a portion of the contents is taken from any bottle, always cork it tightly afterwards. The laboratory supply of chemicals can be kept in the original bottles as a rule, it will seldom be necessary to transfer anything to another bottle.

(To be continued.)