

**LABORATORY
MANUAL OF
GENERAL CHEMISTRY**

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Laboratory Manual of General Chemistry by R. P. Williams

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R. P. WILLIAMS

**LABORATORY
MANUAL OF
GENERAL CHEMISTRY**

LABORATORY MANUAL
OF
GENERAL CHEMISTRY.

INCLUDING

DIRECTIONS FOR PERFORMING ONE HUNDRED OF THE MORE
IMPORTANT EXPERIMENTS IN GENERAL CHEMISTRY AND
METAL ANALYSIS, WITH BLANKS AND A MODEL FOR
THE SAME, LABORATORY RULES AND SUGGES-
TIONS, AND TABLES OF ELEMENTS, COM-
POUNDS, SOLUTIONS, APPARA-
TUS, AND CHEMICALS.

*PREPARED FOR USE WITH ANY TEXT-BOOK OF CHEM-
ISTRY; SPECIALLY ADAPTED TO ACCOMPANY
"INTRODUCTION TO CHEMICAL SCIENCE."*

BY

R. P. WILLIAMS, A.M.,

INSTRUCTOR IN CHEMISTRY, ENGLISH HIGH SCHOOL, BOSTON, AND
AUTHOR OF "INTRODUCTION TO CHEMICAL SCIENCE."

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APPARATUS FOR EACH LOCKER.

[APPARATUS AND CHEMICALS CAN BE OBTAINED OF DR. A. P. GAGE, BOSTON. "INTRODUCTION TO CHEMICAL SCIENCE" IS PUBLISHED BY GINN & Co., BOSTON].

- 2 horseradish (or olive) bottles, and corks to fit.
- 1 soda bottle.
- 2 pieces window glass (3 in. sq.).
- 2 pieces glass tubing (20 in. long, $\frac{1}{4}$ in. diam.).
- 1 glass stirring-rod.
- 1 glass funnel (3 in., 60°).
- 1 piece ignition tubing (12 in. long, $\frac{1}{4}$ in. diam.).
- 1 porcelain evaporating dish (3 in. wide).
- 1 asbestos paper, or wire gauze (3 in. sq.).
- 1 iron (or tin) plate (5 or 6 in. diam.).
- 1 pair forceps.
- 1 three-cornered file.
- 1 round file.
- 1 copper wire (15 in. long).
- 6 test tubes, and corks to fit.
- 1 wooden test-tube holder.
- 1 thistle-tube.

APPARATUS FOR GENERAL USE.

Flasks (200^{cc}).
Bunsen burners.
Rubber tubing (18 in. long, $\frac{1}{4}$ in. diam., inside).
Iron ring-stands.
Reagent bottles (250 and 500^{cc}).
Metric rulers (30^{cm} long).
Graduates (25^{cc} and 200^{cc}).
Scales with metric weights (1-100^g).
Pneumatic troughs.
Glass tubing ($\frac{1}{4}$ in. outside diam.).
Glass tubing ($\frac{3}{8}$ in. diam.), 2 lbs.
Hessian crucibles (50 or 100^{cc}).
Beakers (25 or 50^{cc} and 2000^{cc}).
Lead trays (5 or 6^{cm} sq., 1 deep).
Mortars and pestles.
Fine wire gauze (No. 50 or 60, 3 in. sq.).
Platinum wire (No. 23).
Blow-pipes.
Bricks.

CHEMICALS.

ESTIMATES FOR A CLASS OF TWENTY.

Acetic acid.....	2 lb.	Litmus paper.....	2 ft.
Alcohol.....	2 lb.	Magnesium chloride.....	2 oz.
Alum.....	4 oz.	Magnesium ribbon.....	2 ft.
Ammonium carbonate.....	2 oz.	Manganese chloride.....	2 oz.
Ammonium chloride.....	1 lb.	Manganese dioxide.....	1 lb.
Ammonium hydrate.....	4 lb.	Magnesium sulphate.....	1 oz.
Ammonium nitrate.....	1 lb.	Marble.....	2 lb.
Ammonium oxalate.....	2 oz.	Mercuric chloride.....	2 oz.
Ammonium sulphate.....	4 oz.	Mercurous nitrate.....	2 oz.
Antimony (metallic).....	$\frac{1}{2}$ oz.	Molasses.....	1 pt.
Antimony chloride.....	2 oz.	Naphtha.....	1 lb.
Arsenic (metallic).....	$\frac{1}{2}$ oz.	Nitric acid.....	7 lb.
Arsenic teroxide.....	$\frac{1}{2}$ oz.	Nickel sulphate.....	1 oz.
Barium chloride.....	3 oz.	Phosphorus.....	$\frac{1}{2}$ lb.
Barium nitrate.....	1 oz.	Picture wire.....	7 ft.
Beeswax.....	3 oz.	Potassium (metallic).....	$\frac{1}{2}$ oz.
Bi-carbonate of soda.....	2 oz.	Potassium bi-chromate.....	4 oz.
Bismuth chloride.....	2 oz.	Potassium bromide.....	2 oz.
Bleaching-powder.....	$\frac{1}{2}$ lb.	Potassium chlorate.....	2 lb.
Bone-black.....	$\frac{1}{2}$ lb.	Potassium chromate.....	1 oz.
Brimstone.....	1 $\frac{1}{2}$ lb.	Potassium cyanide.....	1 oz.
Calcium chloride.....	2 oz.	Potassium ferrocyanide.....	2 oz.
Calcium sulphate.....	1 oz.	Potassium hydrate.....	$\frac{1}{2}$ lb.
Candles.....	—	Potassium iodide.....	2 oz.
Cannel coal.....	$\frac{1}{2}$ lb.	Potassium nitrate.....	$\frac{1}{2}$ lb.
Carbon bisulphide.....	2 oz.	Potassium nitrite.....	2 oz.
Charcoal.....	$\frac{1}{2}$ lb.	Silver nitrate.....	1 oz.
Cobalt nitrate.....	$\frac{1}{2}$ oz.	Soap.....	$\frac{1}{2}$ lb.
Cochineal.....	$\frac{1}{2}$ oz.	Sodium (metallic).....	$\frac{1}{2}$ oz.
Coins.....	—	Sodium arsenite.....	2 oz.
Copper (flings or turnings).....	1 lb.	Sodium carbonate.....	1 lb.
Copper nitrate.....	3 oz.	Sodium chloride.....	1 lb.
Copper oxide.....	2 oz.	Sodium hydrate.....	1 lb.
Chlorhydric acid.....	10 lb.	Sodium hyposulphite.....	$\frac{1}{2}$ lb.
Ferrous sulphate.....	4 oz.	Sodium nitrate.....	$\frac{1}{2}$ lb.
Ferrous sulphide.....	3 lb.	Sodium sulphite.....	1 oz.
Filter papers (4 in.).....	1000	Sodium phosphate.....	3 oz.
Fluor spar (powdered).....	3 oz.	Starch.....	$\frac{1}{2}$ lb.
Fuming sulphuric acid.....	$\frac{1}{2}$ lb.	Strontium chloride.....	1 oz.
Gold leaf.....	4 in. sq.	Sugar.....	$\frac{1}{2}$ lb.
Indigo.....	1 oz.	Sulphuric acid.....	12 lb.
Iodine.....	$\frac{1}{2}$ oz.	Tin chloride.....	2 oz.
Lead.....	$\frac{1}{2}$ lb.	Turkey red cloth.....	$\frac{1}{2}$ yd.
Lead acetate.....	2 oz.	Turpentine (spirits).....	1 oz.
Lead nitrate.....	$\frac{1}{2}$ lb.	Water glass.....	1 lb.
Lead protoxide.....	1 oz.	Yeast.....	1 cake
Lime (unslaked).....	1 lb.	Zinc.....	1 lb.
Litmus.....	1 oz.	Zinc sulphate.....	2 oz.

RULES AND SUGGESTIONS FOR THE LABORATORY.

1. Each pupil must furnish a cloth or sponge to keep his table clean, and any apron or other clothing desired for use in the laboratory. These latter are indispensable for preserving the clothing.

2. The table occupied by pupils must be left clean and dry after every laboratory exercise. Wash and wipe dry a ring stand, or any other apparatus on which a reagent has fallen, wipe out a p.t. after using it, and keep reagent bottles, other apparatus, books, and lockers clean.

3. Pupils are held responsible for apparatus, and must replace anything that is broken or lost.

4. Have every d.t. and stopper fit tightly, to prevent leakage of gas.

5. In heating a t.t. on the r.s., hold the lamp in the hand, moving it slowly.

6. Mixtures of solids should be made on paper or in an e.d. Be careful not to mix chemicals or reagents except as directed.

7. To shake the contents of a t.t., cover its mouth with the thumb or the hand, hold it away from the table, and shake it vigorously.

8. Never put down a stopper when using a reagent bottle, but hold it between the first and second fingers, and replace it as soon as you are through using it. Do not pour back any excess of a reagent from a t.t. or other rec. into a reagent bottle, and do not dip a stirring-rod into a reagent bottle.

9. In pouring a liquid into a graduate or t.t., hold the latter on a level with the eye, placing the thumb-nail at the upper limit to which it is desired the liquid should reach.

10. Pour only liquids or fine powders into the bowls, always opening the jet at first, to let the water run. Solids should be thrown into the jars.

11. Have flasks and t.t. perfectly dry on the outside before applying heat. If there are no racks for t.t., they may conveniently rest in the rec. when not in use.

12. Reagents for general use must not be taken to the individual's table, but must be left at the side-table.

13. In experimenting, follow the directions as closely as possible. Read an exp. through before performing any part of it. Ask an explanation of anything you do not understand.

14. Read the "Model for Taking Notes." Begin to write your notes on the page opposite the exp. Both name and symbolize substances once in each exp.; as, manganese dioxide, MnO_2 . After that use the symbols only. In writing equations, use only symbols.

15. In memorizing exps., learn names, symbols, processes, products, and reactions. Do not try to remember quantities.

16. Try to enter into the spirit of the work, by making close observations, and ascertaining what each exp. teaches. Always state whether heat has to be applied, whether the action is vigorous, and what is the color and what the state of the product.

17. No notes are to be written in this book outside of the laboratory, without special permission. Books must be brought to the teacher for inspection after each exp., and must be left in the laboratory at the end of the hour.

18. With the book closed, write your name and the division to which you belong distinctly across the front edge, in Roman letters.

19. For burns, put some dried Na_2CO_3 , or $HNaCO_3$ on a handkerchief, moisten it, and bind it on the part affected. If taken in season no blister need occur, and the pain is soon allayed.