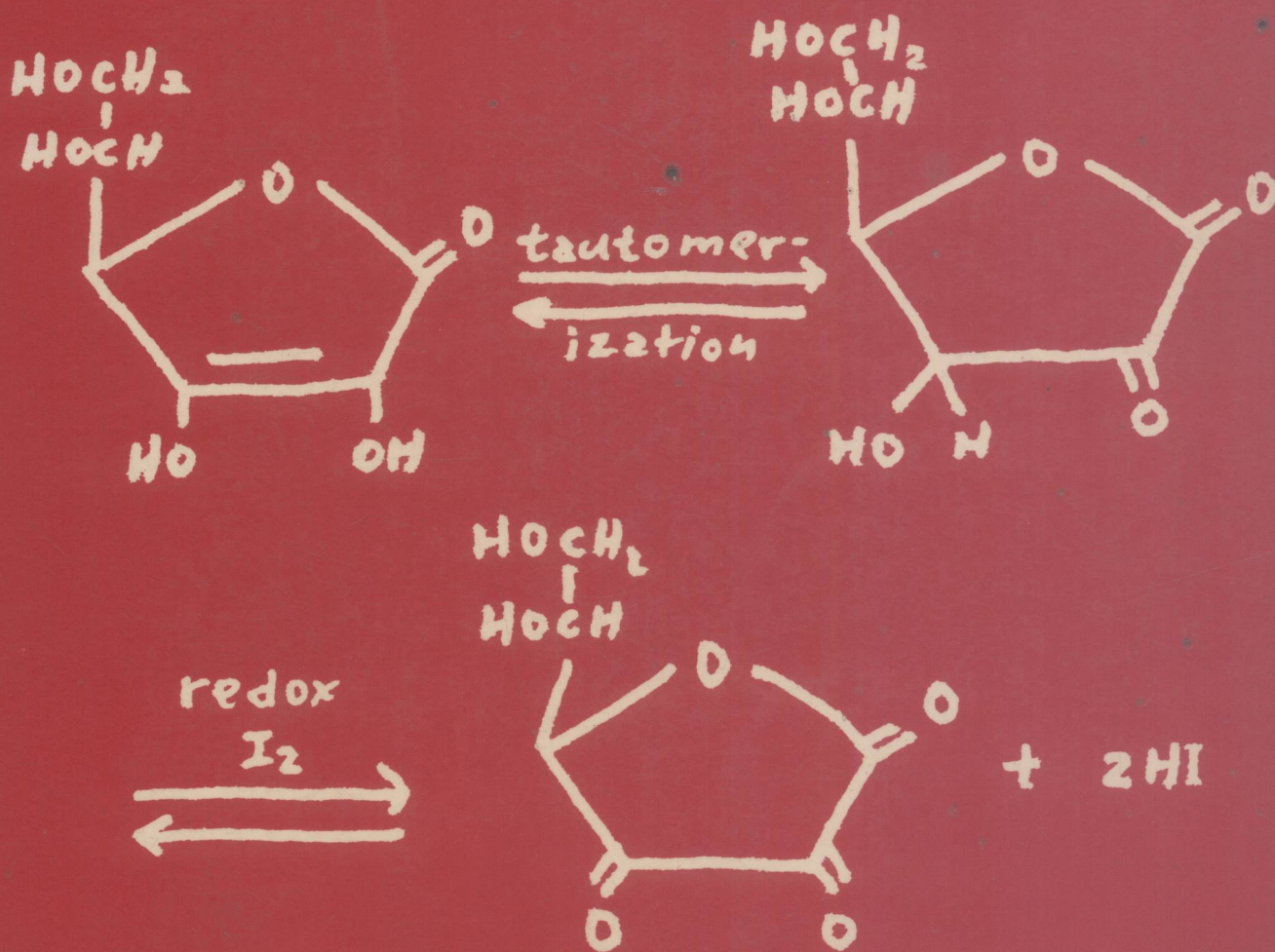


Experiments in General, Organic, and Biological Chemistry



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Experiments in General, Organic, and Biological Chemistry

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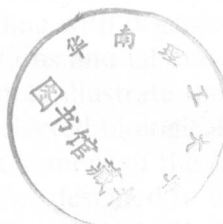
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General,
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Biological Chemistry

Preface

This manual is intended for students who have not necessarily had any previous background in chemistry and who are preparing for a career in nursing or other allied health occupations. The first part of the manual emphasizes *general chemistry* and is at the appropriate level for students in a one-semester liberal arts and sciences course in chemistry. In fact, the first ten experiments have been used for such a course at the University of Kansas for several years.

The manual can be used with any textbook written for students planning careers in the health sciences. There are more than enough experiments for a two-semester or a three-quarter course, thereby allowing flexibility in the laboratory curriculum. The general chemistry experiments (1–12) parallel the sequence of topics normally covered in an introductory course. These are followed by a series of experiments dealing with organic compounds, demonstrating a variety of organic reactions and laboratory techniques. Experiments in the last third of the manual illustrate the properties and methods of separation and analysis of selected biological compounds.

Each experiment is preceded by a statement of the *objectives* of the experiment and by *prelaboratory questions* designed to encourage the student to study the manual prior to the laboratory period. In the earlier experiments, answers to these questions are in the *discussion* section. More challenging questions are given at the end of each experiment. Special safety precautions are inserted, where appropriate, in the text of the *experimental procedure*.

Most of the experiments can be completed easily within a three-hour laboratory period. Students may work individually or in pairs, depending on the availability of equipment. The data sheets are designed to be separated from the manual and turned in to the instructor at the end of the laboratory period. Alternatively, some laboratory instructors may require that laboratory notebooks be kept by the students.

An Instructor's Guide for this manual is available that (1) lists equipment needed for each experiment, (2) gives directions for making the required reagents, (3) suggests topics for prelaboratory lectures, (4) discusses safety precautions, (5) describes ways in which laboratory time may be used most efficiently, and (6) provides answers to the prelaboratory and postlaboratory questions.

To the Student

This may be your first experience with the science known as chemistry, and you may have special reservations about the laboratory part of the course. No doubt you have heard tales of bad smells, fires, poisons, and even explosions in chemistry laboratories. Rest assured that the experiments in this manual have been carried out by thousands of students like yourself without a serious accident. These experiments were chosen so as to exclude chemicals and procedures that are truly dangerous. Whenever a potentially harmful process or chemical must be used, a CAUTION statement is given in the instructions. Use of common sense and strict adherence to the safety rules should minimize even minor accidents.

This laboratory manual was designed for students who have not necessarily had any previous experience with chemistry and who do not intend to become professional chemists. The first experiments provide an easy introduction to the equipment and techniques used in chemical laboratories. Those in the second half of the manual provide a good practical background for students who plan to enter one of the health care professions.

The laboratory is a place to learn and to solve problems. In many cases you will probably begin an experiment without a complete understanding of what you should do and what the experiment means. Don't be worried that you do not understand everything when you begin an experiment. After all, you are doing the experiment and taking the course to *learn* chemistry. Your efforts in the laboratory should be directed toward first understanding what is happening and then incorporating this knowledge into your overall understanding of chemistry. Ask for assistance from your laboratory instructor or your neighbor when you need it.

It is important that you read over an experiment, particularly the DISCUSSION section, *prior* to your laboratory period. You should be able to answer the PRELABORATORY QUESTIONS before you enter the laboratory. In some cases you may want to consult your chemistry textbook for a more detailed discussion.

We believe these experiments will help you understand chemistry, and we sincerely hope that you will find the laboratory part of your course to be both meaningful and fun!

Safety Rules and First Aid Procedures

Telephone number for Emergency Medical Aid _____

Telephone number of Fire Department _____

Location of nearest:

Safety Shower _____

Eyewash Fountain _____

Fire Extinguisher _____

Fire Blanket _____

Emergency Exit _____

First Aid Station _____

GENERAL SAFETY REGULATIONS

1. *Approved* safety goggles must be worn at all times in the laboratory, except when their removal is authorized by the laboratory instructor.
2. Laboratory work will be performed only under the supervision of the laboratory instructor.
3. Unauthorized experiments are forbidden. When in doubt about the safety of an experiment, consult your instructor.
4. Horseplay and throwing objects in the laboratory can endanger others and are forbidden.
5. Know how to use the safety shower, eyewash fountain, fire extinguisher, and fire blanket.
6. Immediately report all injuries or accidents such as cuts, burns,

substances in the eye, chemical spills, and broken glass to your laboratory instructor.

7. Eating, drinking, and smoking in the laboratory are forbidden. Never taste or deeply inhale any laboratory chemical.
8. Dress appropriately. Loose-fitting clothing and long hair may fall into a burner flame. Do not use hair spray or other hair-styling chemicals prior to entering the laboratory. Shoes must be worn. Sandals and shorts are not permitted.
9. Do not point heated test tubes at anyone. Take care when transporting long or sharp items of equipment so as not to injure anyone.
10. Always use a pipet bulb with a pipet. Never draw a liquid into a pipet by mouth.
11. Use equipment properly. Books, beakers, and boxes are not suitable as supports for laboratory apparatus.
12. Be cautious when testing odors of chemicals. Use your hand to waft vapors toward your nose. Use hoods when handling volatile chemicals. Prior to beginning an experiment, familiarize yourself with properties of the chemicals to be used.
13. Keep your laboratory drawer and bench clean and make sure all equipment is clean before you leave the laboratory. Clean up any chemical spills immediately.
14. Consult your laboratory instructor before discarding chemicals. Special methods of disposal are necessary for certain chemicals.
15. It is a good idea to wash your hands frequently when handling chemicals. Wash your hands when leaving the laboratory.

FIRST AID

Be prepared to administer first aid as follows:

Chemicals in the Eyes

Immediately flush with copious amounts of water at the eyewash fountain and continue to wash for *at least 15 minutes*. The injured person should keep his or her eyes open, or hold them open with the eyelid rolled back, while flushing with water.

If the injured person is wearing contact lenses, remove them *after* flushing the eyes with water for several minutes, then continue flushing.

Finally, cover the eyes loosely with a clean bandage or cloth and see a doctor. Emergency medical treatment and an ambulance may be desirable.

Corrosive Chemicals on the Skin

Wash immediately with lots of cold water. Remove any clothing that has been contaminated with the chemical and continue to wash the skin with cold water for at least 15 minutes. If the skin is not broken, wash the area gently with a

mild detergent and water, then proceed immediately to a doctor if the burn appears serious. Special treatments for specific chemicals will be suggested as they are encountered in the experiments. *Do not* use neutralizing chemicals, ointments, creams, or lotions. If in doubt about the seriousness of the burn, see a doctor. Emergency medical treatment and an ambulance may be desirable.

Burns Due to Fires and Hot Objects

Hold the burned area under cold water for several minutes, then wrap with sterile gauze. *Do not* apply ointment to the burn. If the burn appears serious, see a doctor.

Cuts

For serious bleeding, call for medical help. Try to reduce the bleeding by applying direct pressure to the wound and, if possible, elevate the injury above the heart. *Do not* apply a tourniquet.

If the cut is minor, allow it to bleed for several seconds, then wash it well with cold water and remove any visible glass or other foreign objects. Apply disinfectant and bandage and go to the Health Service for a more thorough check.

Fires

If clothing or hair catches fire, either smother the fire with a fire blanket (or any immediately available heavy clothing such as a coat) *or* drench the victim with the safety shower, whichever is nearer. The spread of flames will be minimized if the victim drops to a horizontal position. Treat burns as described above.

If the fire is confined to a reaction apparatus, extinguish it with a fire extinguisher. A small fire in a beaker can usually be extinguished by covering it with a wet towel—but do not attempt to move the burning apparatus to another location.

In case of larger fires, evacuate the room and call the fire department.

Ingestion of Chemicals

Call for medical help. If the victim is conscious, have him or her drink large amounts of water. Try to determine what was ingested in order to inform medical personnel.

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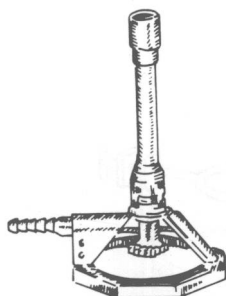
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Laboratory Equipment

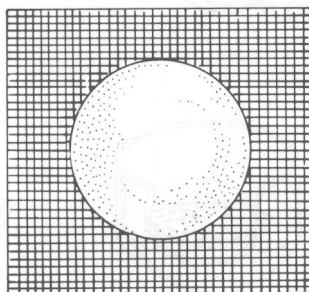
Items of laboratory equipment used during the experiments in this manual are illustrated on the following pages. Special items that are needed for some of the experiments will be identified by your instructor.



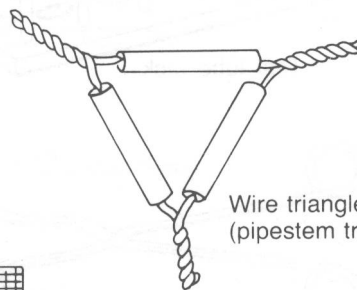
Gas, or Bunsen, burner



Flame spreader
(wing top)



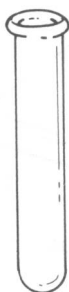
Wire gauze, with ceramic center



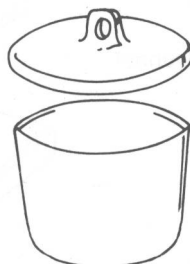
Wire triangle
(pipestem triangle)



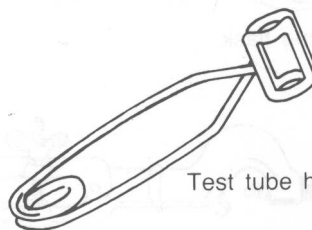
Watch glass



Test tube



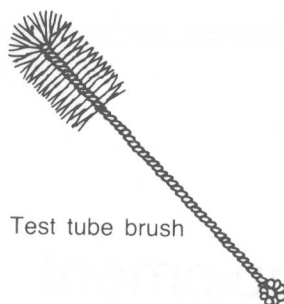
Crucible and cover



Test tube holder



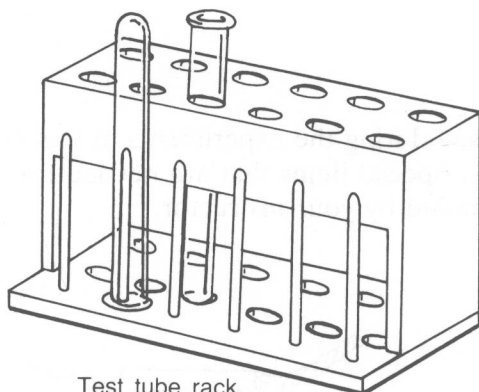
Evaporating dish



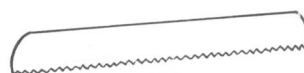
Test tube brush



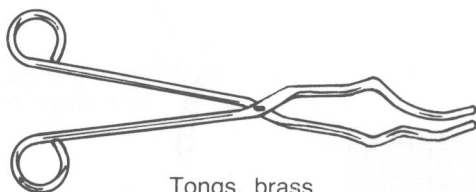
Thermometer



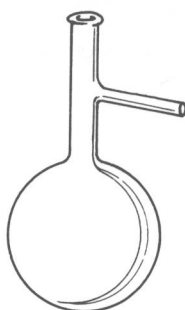
Test tube rack



Scriber



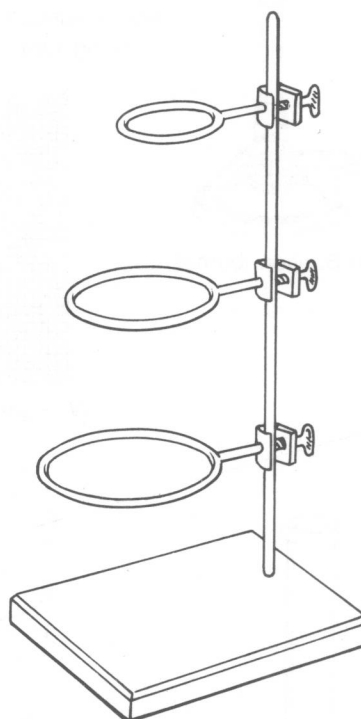
Tongs, brass



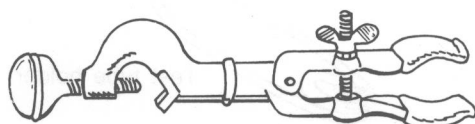
Distilling flask



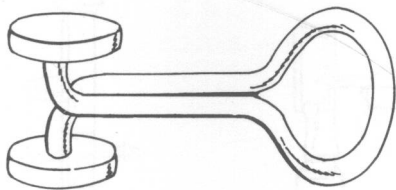
Büchner funnel



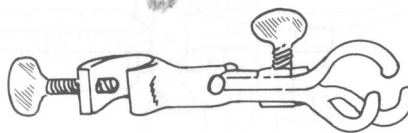
Ringstand, with rings



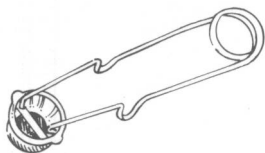
Buret clamp



Pinchcock clamp, Hoffman



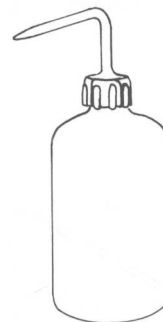
Condenser clamp



Gas lighter



Deflagration spoon



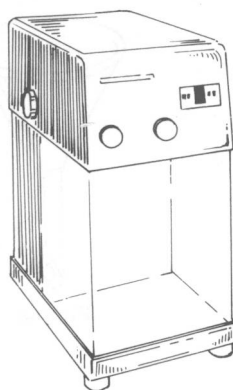
Wash bottle



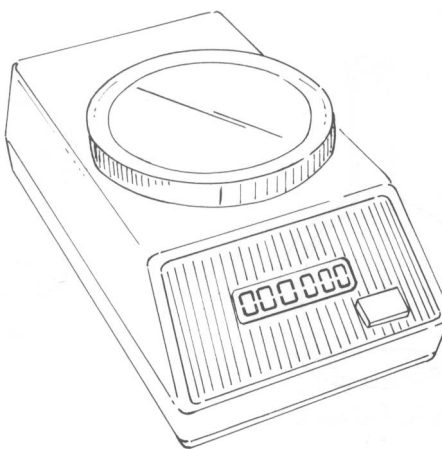
Forceps



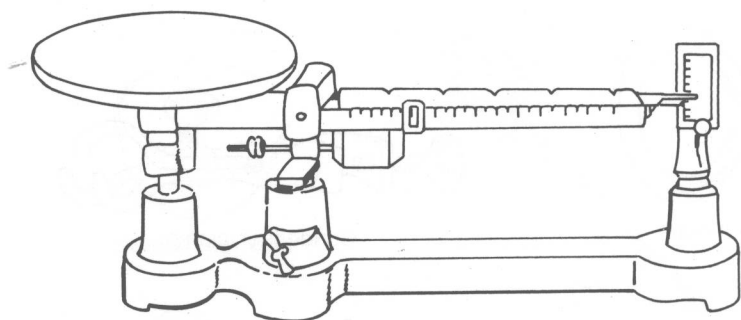
Triangular file



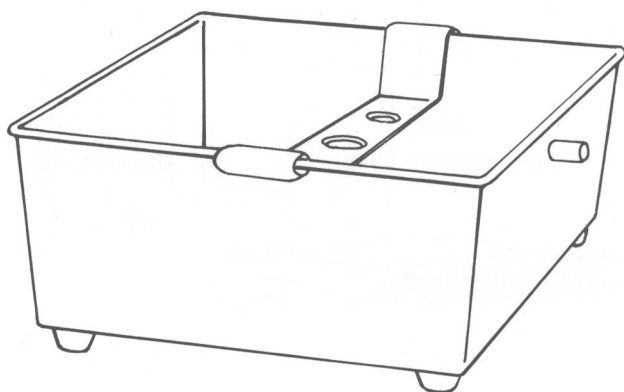
Analytical balance



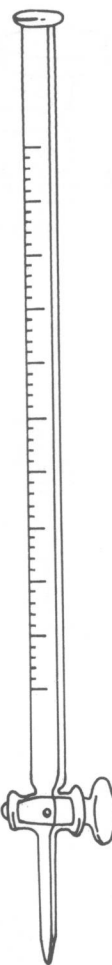
Top-loader balance



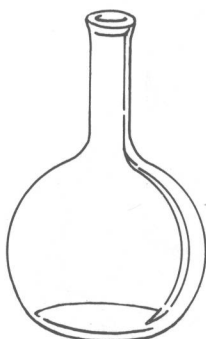
Triple-beam balance



Pneumatic trough



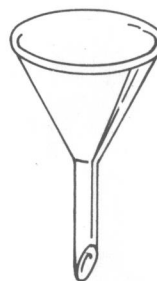
Buret with stopcock



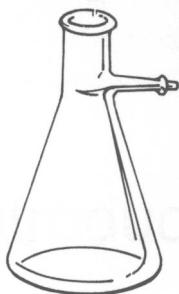
Flask, Florence



Beaker



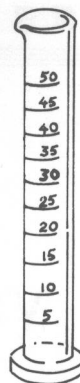
Funnel



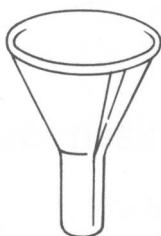
Filter flask



Mortar and pestle



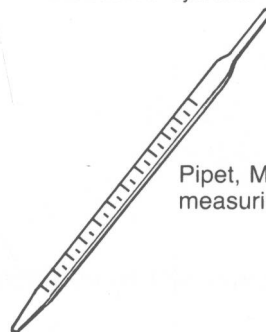
Graduated cylinder



Powder funnel



Flask, Erlenmeyer



Pipet, Mohr
measuring type

