1.7. INTRODUCTION TO THE LABORATORY

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1. SAFETY

Be sure that you are familiar with the locations and use of the following safety equipment:

1. Fire extinguishers, mounted in various locations in the lab.
2. Showers, one in each of the labs near the corridors.
3. Eye wash stations/face sprays, one at each sink in the center aisle.
4. Fire blankets, at each end of the lab near the corridors and near the power control panel.
5. Telephone - to be used for emergency calls only - **DIAL 100**.

Only CO_2 and dry-chemical fire extinguishers should be used on chemical or electrical fires. Water faucets at sinks may be used to wash skin exposed to corrosive chemicals. You should note the location of this safety equipment in your working areas and be sure (even rehearse) what you would do in the case of a fire or other accident. However, in the event of fire or other accident, do not take any action that would risk the safety of yourself or others. Most importantly, make any emergency known as soon as possible to a TA or staff member.

You must wear **safety goggles** in the laboratory at all times. *This is a Massachusetts state law, not just a lab regulation*. Although radios and musical instruments are not technically considered safety hazards, they will not be allowed in the laboratory.

Learning about the hazards of materials, equipment, and procedures used in chemical laboratories is a part of the educational objective of this subject. We will discuss matters of safety pertaining specifically to this course during our first meeting on Monday, January 6. The discussion will prepare you for hazards encountered in an undergraduate lab. At this time, you will also receive a copy of the MIT Chemistry Department's *Chemical Hygiene Plan and Safety Manual*, which will serve as your safety reference throughout your MIT career.

Disposal of solvents, chemicals and other materials:

Never pour solvents or reactive chemicals down a drain. Such careless handling of flammable or toxic liquids presents a serious hazard in the laboratory. Also, never keep an open beaker of such solvents outside a hood. Chlorinated solvents are poured into solvent waste containers kept inside the hoods in 4-454 and 4-460. When in doubt about how to dispose of something, ask a TA. If drain disposal is necessary and acceptable, always flush the drain before, during, and afterwards with a lot of water, always using the drains in the hoods. **All glass must be discarded in the specially designed containers.** A dust pan and brush for broken glass can be checked out of Lab Supplies (4-450). Spilled mercury is a special safety hazard and should be reported to your TA for cleanup.

2. CHECK-IN PROCEDURE

After a brief tour of the undergraduate labs (including instrumentation and safety equipment), the Lab Check-In Procedure will begin. You will be assigned a lab bench and should obtain the following items:

1. A sheet of safety regulations - you must read, sign, and turn in this sheet.
2. Desk assignment and key, a list of desk equipment and Check-In Sheet
3. Safety goggles, lab coat, and a lab notebook (required for 5.301).
4. A list of 5.301 specific equipment.

Check the equipment in your cabinet against the list given to you by the TA. Report any discrepancies to the TA, who will either give you the missing item or instruct you to obtain it at the Laboratory Supplies Stockroom. Once you have signed the Check-In Sheet, you are responsible for the items in your desk. At the termination of the course, even if the course is dropped the following day, it is your responsibility to check-out of the laboratory (see Item 3 below).

3. CHECK-OUT PROCEDURE AND CHARGES

Check-out will be on **Thursday, January 29, 2004**. Students who do not check out as scheduled will be checked-out by the Office of Laboratory Supplies. For this service, the student's personal account will be charged $35.00.

4. LOCATIONS OF LABORATORY EQUIPMENT

a. Chemicals and Solvents

Organics and Inorganics - 4-457

Acids and Bases - under hood in 4-457

Solvents - 4-454 and 4-460, on shelves at end of benches

b. Ovens and Refrigerators

Ovens are located in 4-454 and 4-460. Each oven is designated for a specific purpose. Do not place any plastic items in the ovens. All samples must be clearly labeled with the identity of compound, your name and date. Ovens will be cleared weekly and improperly labeled samples will be removed. Refrigerators - 4-454. Samples must be clearly labeled.

c. Balances. Abuse of balances and littering of the area will not be tolerated.

d. Common Laboratory Items

The following items are available from LS (LS = Lab Supplies):

vials and labels for submitting samples

filter paper, 17 mm, 5 1/2 cm, 11 cm

rubber stoppers, rubber septa and rubber bands

pliers, needle-nosed, file, glass tubing and other hardware

sponge, spill pillow absorbent dust pan and brush

5. SAFETY IN THE M.I.T. UNDERGRADUATE CHEMISTRY LABORATORIES

Protection of the health and safety of individuals in the laboratory and respect for preservation of the environment are regarded by the Chemistry Department as moral imperatives. A good safety program requires everyone to share the responsibility - faculty, staff, and students. The safety program in these laboratories is headed by the Undergraduate Laboratory Director, Dr. Mircea Gheorghiu, and includes an Undergraduate Laboratory Safety Committee composed of faculty, teaching assistants and students.

Safety information will be provided in a number of ways. Each laboratory subject begins with a mandatory safety lecture to provide general information and advice. In addition, the instructions for each experiment and the accompanying TA presentations will contain safety information specific to each experiment. Reference works with various sorts of data on chemicals used in the laboratory will be on file and available in the reference room outside Dr. Gheorghiu's office. One of these, *Prudent Practices in the Laboratory*, is especially recommended as a readable comprehensive document on the subject.

The laboratory policy regarding toxic substances is to design experiments and procedures that keep levels of exposure below the threshold limit values (TLV's) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). This is a conservative policy, since these TLV's are regarded as safe for indefinite periods of exposure for 40 hours a week in the work place. Copies of the ACGIH-recommended TLV's are available for reference.

Notwithstanding the department's unswerving commitment to safe undergraduate laboratories, it is important to bear in mind that an absolutely *risk-free* teaching environment is neither possible nor desirable. Hazards abound in daily life. Gasoline, for example, is both explosive and toxic, yet most car-driving citizens are confident that they know how to handle it safely. Anyone considering a career in the experimental sciences or in medicine needs to learn how to handle a great variety of potentially dangerous substances with informed caution and competence. One of the objectives of the undergraduate laboratory subjects is to provide that kind of education for safe behavior and practices in the laboratory and in the outside world.

A list of basic rules for safety in the laboratory, which you should be familiar with, is appended. It is also imperative that you become familiar with your copy of *The Chemical Hygiene Plan and Safety Manual*. Strict adherence to the guidelines outlined in both of these references will promote a safe and successful lab experience.

6. GENERAL SAFETY RULES FOR THE UNDERGRADUATE LABS

1. The safe way is the right way to do your job. Plan your work. Follow instructions. If you do not know how to do the experiment safely, ask your teaching assistant.

2. Be able to use all safety devices and protective equipment provided for your use and *know their location* (eyewash fountain, shower, fire blanket, fire extinguisher).

3. Safety goggles must be worn at all times.

4. *Do not* eat or drink in the laboratory (and do not store food in the refrigerators). Smoking in the laboratory is absolutely forbidden.

5. Personal effects: wear proper clothing (including protective clothing when handling corrosive, toxic, or flammable materials). Avoid loose sleeves, loose cuffs, bracelets. Be careful with long hair. Proper shoes are required (no sandals).

6. Horseplay in any form is dangerous and prohibited. Do not run in laboratory areas.

7. If you see a colleague doing something dangerous, point it out to him or her and to the TA.

8. Report to your TA all unsafe conditions, unsafe acts, and "near misses" that might cause future accidents. Report any accident or fire, no matter how trivial, to the TA.

9. Hazardous Chemicals:
   a. Be especially mindful of fire hazards when you *or your lab neighbors* are working with flammable liquids.
   b. Hazardous Substances: Know common explosive, toxic, and carcinogenic materials and use them only with adequate safeguards.

10. Never leave a reaction or experiment running unattended, unless you have told your lab partners enough about it to deal with potential hazards while you are away.

11. Keep hood and benchtop areas clean and workable space maximized.