

## Personal Safety In The Laboratory

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Lab safety is one of the most critical concerns of any lab. To help improve lab safety, Corning has compiled these common sense suggestions concerning the safe use of glass and plastic labware. For more detailed information please refer to the safety manuals provided on-line (see the Useful Safety Links section, below).

### Useful Safety Links

The following links provide detailed safety information on a variety of important topics:

1. Biosafety in Microbiological and Biomedical Laboratories, HHS Publication No. (CDC) 93-8395, <http://bmbi.od.nih.gov>
2. High School Chemistry Laboratory Safety Guide, Center for Disease Control, <http://www.cdc.gov/niosh/docs/2007-107/>
3. Laboratory Biosafety Guidelines, Health Canada, Health Protection Branch - Laboratory Centre for Disease Control, <http://www.phac-aspc.gc.ca/publicat/lbg-ldmbl-04/index.html>
4. Safety Manual, Safety and Environmental Protection Office, Hong Kong University of Science and Technology, <http://www.ab.ust.hk/sepo/>

### General Precautions

**Never drink from a beaker.** A standard beaker or other laboratory vessel used specifically for drinking is a personal health hazard in the laboratory. Use disposable or recyclable cups. Never drink from any standard laboratory product to avoid any possibility of personal injury or health hazard.

### Centrifugation

When centrifuging pathogenic organisms, clinical specimens known or suspected of being infectious, or any other potentially biohazardous materials, approved safety containment systems should be used. Contact your centrifuge manufacturer for appropriate accessories or recommendations.

Read protocols and instruction manuals carefully. Do not confuse speed or revolutions per minute (RPM) with relative centrifugal force (RCF). Instructions for centrifuging a sample at a given RPM and time are incomplete unless the rotor or radius is specified. Protocols should always state the time and RCF value for centrifuging a sample.

Tubes to be used in angle-head centrifuges must never be filled to the point that liquid is in contact with the lip of the tube when it is placed in the rotor, even though the meniscus will be vertical during rotation. When the tube lip is wetted, high G forces will drive the liquid past the cap seal and over the outside of the tube.

Proper balancing and distribution of the load in a centrifuge is critical for optimum performance and to prevent damage to the tubes or centrifuge. Opposing buckets or loads should always be balanced within the range specified by the manufacturer. Tubes should always be distributed in the buckets with respect to the center of rotation as well as the pivotal axis of the bucket. Failure to do this may prevent the bucket from achieving a horizontal position during the centrifugation run. Uneven separations or tube failure may result. If vibration occurs the centrifuge should be stopped immediately and load balances checked. Swing-out buckets should be checked for clearance and support. Lids shall be closed at all times during operation.

### Cryogenic Storage

Because of the extremely low temperatures of cryogenic liquids and their vapors, direct skin or eye contact can result in severe damage to tissues similar to burn injuries. The most commonly used cryogenic liquid is liquid nitrogen which has a temperature of -198°C. In general, it should be remembered that cryogenic liquids are extremely cold and that a small amount of volume of liquid produces a large volume of gas (expansion ratio is approximately 700:1 for liquid nitrogen). Appropriate safety equipment (gloves, face shields, biological safety cabinets, hoods, etc.) should always be used to protect personnel when removing vials or ampules from cryogenic storage systems. Gloves should be loose fitting so that quick removal is possible if liquid should splash into them. Even with gloves, contact with cold

liquids should be for a very brief time. Cryogenic liquids should be stored and handled in well-ventilated areas to prevent excessive buildup of gas concentration. These should never be used in closed environmental chambers.

Due to the extremely low temperatures encountered during cryogenic storage, not all vessel materials or designs are suitable or safe. Many materials become very brittle at these temperatures; vessels made from them may shatter or crack during storage or thawing. Carefully check the vessel manufacturers' recommendations on proper selection and use.

To avoid injury, **DO NOT** immerse plastic or glass cryogenic vials in liquified nitrogen gas. Vials immersed in liquified gases can develop leaks. When they are eventually returned to room temperature, pressure can rapidly buildup and shatter the vials and cap seals. Harmful or biohazardous materials contained in the vials may be released. Always store vials above liquid nitrogen to reduce these potential hazards.

### **Safety Precautions**

Corning filter units are intended for use by persons knowledgeable in safe laboratory practices. Safety is one of the most critical concerns of any lab. Because of variations in conditions, Corning cannot guarantee any glassware or plasticware against breakage under vacuum or pressure. Failure can result from surface damage, improper pressure or temperature, or use with incompatible chemicals. Adequate precautions should always be taken to protect personnel doing such work. To help improve lab safety, Corning has compiled these common sense suggestions concerning the safe use of filtration products:

- Use of vacuum-driven filters on glass or plastic bottles may cause personal injury if they implode during use. Eye protection is strongly recommended whenever glass or plastic vessels are used under partial vacuum negative pressure to guard against these injuries. Only bottles specifically designed for these applications should be used.
- Never use the 45mm threaded bottle top filters on PYREX or PyrexPlus brand Media Bottles larger than 2 liter capacity or that are square. Use of bottle top filters with PYREXPLUS Media Bottles (with plastic safety coatings) is highly recommended for vacuum filtration.
- Never use the 33mm threaded bottle top filters on standard glass media bottles that are larger than 500mL or on bottles that are not cylindrical.
- Never use plastic roller bottles as substitute receiver bottles during vacuum filtration.
- Do not use a bottle for vacuum applications if it is not designed to withstand a vacuum; if the bottle is scratched, chipped or cracked; if the bottle is clamped in such a way as to induce stress; or if the bottle is being hand held.
- Care must be taken when using syringe filters with small syringes (5mL or less) as the pressures generated may exceed the 75psi limit, causing a possible membrane or housing failure. Loss of valuable contents and personal injury may result. If clogging causes slower flow rates, we recommend that you replace filters rather than increase the pressure.

### **Safely Using Chemicals**

When working with volatile materials, remember that heat causes expansion, and confinement of expansion results in explosion. Remember also that danger exists even though external heat is not applied.

Do not mix sulfuric acid with water inside a cylinder. The heat from the reaction can break the base of the vessel because of the thickness of the base and the seal.

Perchloric acid is especially dangerous because it explodes on contact with organic materials. Do not use perchloric acid around wooden benches or tables. Keep perchloric acid bottles on glass or ceramic trays having enough volume to hold all the acid in case the bottle breaks. Always wear protective clothing when working with perchloric acid.

Glass will be chemically attacked by hydrofluoric acid, hot phosphoric acid and strong hot alkalis, so it should never be used to contain or to process these materials.

Always flush the outside of acid bottles with water before opening. Do not put the stopper on the counter top where someone else may come in contact with acid residue.

Mercury is highly toxic. Special care is needed when dealing with mercury. Even a small amount of mercury in the bottom of a drawer can poison the room atmosphere. Mercury toxicity is cumulative, and the element's ability to amalgamate with a number of metals is well known. After an accident involving mercury, the area should be cleaned carefully until there are no globules remaining. All mercury containers should be well labeled and kept tightly closed.

**Identifying chemicals** - DO NOT taste chemicals for identification. Smell chemicals only when necessary and only by wafting a small amount of vapor toward the nose.

**Label with care** - Never fill a receptacle with material other than that specified by the label. Label all containers before filling. Dispose of the contents of unlabeled containers properly. All bottles and containers holding chemicals shall be accurately and clearly labeled. Whenever possible, hazards and necessary precautions shall also be included on the label.

### **Safely Handling Glassware**

Handle glassware carefully. Hold beakers, bottles and flasks by the sides and bottoms rather than by the tops. The rims of beakers or necks of bottles and flasks may break if used as lifting points. Be especially careful with multiple neck flasks.

**Avoid Over Tightening Clamps** - To avoid breakage while clamping glassware, use coated clamps to prevent glass-to-metal contact, and do not use excessive force to tighten clamps.

### **Safely Using Heat Sources**

Be sure to check laboratory or instruction manuals when working with heat sources.

### **Bunsen Burners**

Adjust Bunsen Burner to get a large soft flame. It will heat slowly but also more uniformly. Uniform heat is a critical factor for some chemical reactions.

Adjust the ring or clamp holding the glassware so that the flame touches the glass below the liquid level. Heating above the liquid level does nothing to promote even heating of the solution and could cause thermal shock and breakage of the vessel. A ceramic-centered wire gauze on the ring will diffuse the burner flame to provide more even heat.

Rotate test tubes to avoid overheating one particular area. Uniform heating may be critical to your experiment. Heat all liquids slowly. Fast heating may cause bumping, which in turn may cause the solution to splatter. Do not heat glassware directly on electrical heating elements. Excessive stress will be induced in the glass, and this can result in breakage.

### **Hot Plates**

There are several types of hot plates. Some are heated electrically, while others are water heated. They may be glass or metal topped. You should consult your instruction manual before using a hot plate for the first time. Always use a hot plate larger than the vessel being heated. Thick-walled items such as jars, bottles, cylinders and filter flasks should never be heated on hot plates.

### **Evaporation**

Evaporation work should be observed carefully. Be careful when handling a vessel that has been heated after evaporation has occurred. It may crack unexpectedly.

### **Heating Thick-Walled Vessels**

Glassware with thick walls such as bottles and jars should not be heated over a direct flame or comparable heat source. We suggest the use of our 16790 Vycor® immersion heater to heat the liquids within these vessels.

### **Scratched Glassware**

Do not heat glassware that is etched, cracked, nicked or scratched. It is more prone to break. (For additional information see "Temperature".)

### **Mixing and Stirring**

Use a rubber policeman on glass, or use Teflon® rods to prevent scratching the inside of a vessel. Do not look down into any vessel being heated or containing chemicals. Do not point a vessel's open end at another person. A reaction may cause the contents to be ejected. Spattering from acids, caustic materials and strong oxidizing solutions on the skin or clothing should be washed off immediately with large quantities of water.

### **Pipetting**

Do not pipet by mouth. For your safety, we suggest using a mechanical pipetting device, such as a rubber bulb or other pipetting aids such as the Costar Stripettor Catalog #4910. Do not draw any liquids into a pipet by mouth. Serious injury could result.

### **Temperature and Temperature Extremes**

**Avoid extremes.** Although Pyrex® and Vycor® brand products can take extreme temperatures, always use caution.

Do not put hot glassware on cold or wet surfaces, or cold glassware on hot surfaces. It may break with temperature change. Cool all labware slowly to prevent breakage, unless you are using Vycor®, which can undergo extreme temperature changes without damage to the glass.

### **Protection from Temperature Extremes**

Burns are caused by heat, ultraviolet or infrared rays and by extremely cold materials. Use goggles and limit your exposure time when working with extra-visual radiation. Never touch dry ice or liquid gases with your bare hands. Use tongs or gloves to remove all glassware from heat. Hot glass can cause severe burns. Protective gloves, safety shoes, aprons and goggles should be worn in case of chemical accidents, spilling or splattering.

### **Exposure to Heat**

The recommended temperature use range for PyrexPlus® labware is 10°C to 80°C. PyrexPlus® labware is designed to withstand the temperatures associated with steam sterilization. Do not place over direct heat or an open flame. Prolonged exposure to dry heat above 80°C may cause the coating to become brittle and thereby reduce the useful life of the vessel. A brown appearance or hardness to the touch are signs that the coating has become brittle and the product should be disposed of.

The upper dry heat temperature limit for PyrexPlus® labware is 110°C (230°F). PyrexPlus® labware should not be exposed to elevated temperatures in a vacuum greater than 5 inches Hg (127mm Hg).

### **Vacuum and Pressure Warning**

All glass containers used in vacuum work or which are under vacuum must be securely and adequately taped or shielded to restrain flying glass in the event of an implosion or other accident. Always wear safety glasses, goggles, or a face shield.

**Because of variations in conditions, Corning cannot guarantee any glassware against breakage under vacuum or pressure. Adequate precautions should be taken to protect personnel doing such work.**

### **Ventilation**

Always work in a well-ventilated area. When working with chlorine, hydrogen sulfide, carbon monoxide, hydrogen cyanide and other very toxic substances, always use a protective mask or perform these experiments under a fume hood in a well-ventilated area. Cryogenic liquids should be stored and handled in well-ventilated areas to prevent excessive buildup of gas concentration. These should never be used in closed environmental chambers.