1.0 PURPOSE:

Laboratory glassware is specifically designed for scientific work. However, by design, it is also fragile and can easily break and cause injuries in the process. There have been many lab accidents at LSU involving the handling of glassware in the lab.

2.0 Select Appropriate Glassware:

Glassware is designed for a specific purpose. It should only be used for that purpose. "Makeshift" apparatus may be unstable and could lead to accidents and injuries. When selecting glassware, determine the compatibility of the glassware with the chemicals or experimental process. Some chemicals react with glass or cause damage (etch) the glass. If your process involves temperature or pressure changes, ensure the glassware can withstand the changes.

Examples of chemical compatibility and glassware to keep in mind:

- Heat causes the expansion of volatile materials. Confinement of expansion results in an explosion. The danger exists even if external heat is not applied.

- Mixing sulfuric acid with water inside a glass cylinder causes an exothermic reaction to occur, resulting in the heat from the reaction breaking the bottom of the vessel. Never mix sulfuric acid inside a cylinder.

- Hydrofluoric acid chemically attacks glass. Hot phosphoric acid and strong hot alkalis also attack the glass. Never use glass to contain these processes.

3.0 Inspect Glassware Before Use

Before working with glassware, always inspect it for flaws. If defects are discovered, glass should be removed from service. Scratches in glass can grow into cracks later. Dispose of flawed glassware if repairs are not possible.

4.0 Handle and Store Glassware Safely

Proper handling of glassware can reduce the risk of injury and accidents.

- Never carry a flask by its neck.
- Never carry a beaker by its side.
- Always use two hands carrying any glassware (position one hand under the glass for support).
- Appropriate gloves should be worn when there is a risk of breakage (e.g., inserting a glass rod), chemical or biological contamination, or thermal hazard.
    - When handling hot or cold glassware, always wear insulated gloves.
- Avoid physical stresses to the glassware. Where necessary, stabilize it by using clamps and platforms to relieve pressure.
    - Avoid overtightening 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.
    - Neck clams should not be used as sole support for vessels larger than 500 ml.
- Ground-glass joints are crafted for a perfect fit and may stick sometimes.
    - Never force a joint free. It can cause the glass to shatter.

- Lubricate surfaces or use a Teflon sleeve.
- A heat gun can gently loosen the joints.

- Never heat or cool glassware unless it is designed for those processes.
  - Round-bottom flasks are best for boiling liquids.
  - Never set hot glass on a cold bench top.

- When storing glassware, remember to:
  - Keep it away from shelf edges.
  - Place glassware toward the back of benches or hoods. (Remember: Fume hoods and biosafety cabinets should not be used for storage.)
  - Don't let instruments roll around in drawers (use drawer pads).

5.0 Glass Rods or Tubing

Setting up apparatus can involve pushing glass tubes through a cork or stopper. Researchers may also attach a rubber policeman to a glass rod. Sometimes researchers will attach a glass Pasteur pipette to rubber tubing for aspiration. All of these procedures have a high risk of injury to your hands if the glass tube, rod, or pipette breaks.

When handling glass rods, tubes, or pipettes remember the following:

- Determine whether the holes are the correct size for the glass material.
- Never force the glass into place.

- Lubricate the hole and tube. Water, soapy water, or glycerin may be used as a lubricant. It is not advised to use oil or grease.

- When possible, wear cut-resistant gloves.

- Hold the glass material with a towel.

- Position the glass material close to the insertion point.

- Gently twist the glass material into place.

6.0 Vacuum and Pressure Operations

Some glassware and processes can present unusual safety risks. Before starting, be sure you have had the necessary training before working with specialized equipment or processes.

Vacuum or pressure operations can severely test the integrity of glassware. Container walls must be able to withstand pressure differences. If the container is not strong enough, the container may implode. Round-bottomed or thick-walled flasks must always be used. Glassware designed for vacuum or pressure operations is rated for specific pressure limits. NEVER place glassware under pressure that it is not designed to withstand.

Glassware that has been repaired or shows signs of defect, flaw, or damage cannot be used in a vacuum system. It is more apt to break through thermal shock. Checking for flaws or defects before use is very important.

When setting up a vacuum system, protective measures must be taken:

- Place all vacuum apparatus behind a blast shield or inside a fume hood. (Remember to lower the sash of the fume hood).

- Always wear appropriate personal protective equipment (safety goggles, face shield, and gloves).

- Use PVC-coated glassware whenever possible. If not available, cover flasks, dewers, and desiccators with tape or mesh.

7.0 Heating and Cooling Glassware

- Check with the glassware manufacturer to determine safe temperature usage. Most glassware can only be exposed to certain high and low temperatures. Usage outside of those ranges may cause damage or breakage to the glassware.

- Always watch evaporation closely. A vessel, heated after evaporation has already occurred, may crack.

- Do not put hot glassware on cold or wet surfaces as it may break with temperature change.

- Never heat glassware that is etched, cracked, chipped, nicked or scratched.

- Glassware with thick walls (e.g., bottles and jars) should never be heated over a direct flame. Additionally, do not heat glassware directly on electrical heating elements.

- Do not look down into a vessel being heated.

- Cool all glassware slowly to prevent breakage, unless using specifically designed glassware.

- Use care when removing glassware from ultra-low temperature freezers (-70° to -150° C) to prevent thermal shock and cracking. For best results, immediately rinse the entire bottle under cold running water until thawing begins. Never place bottles directly from the freezer into warm water baths.

- When using a Bunsen burner, the flame should touch the glass below the liquid level. A ceramic-centered wire gauze will diffuse the burner flame to provide more even heat.

- Always use hotplates that are larger than the bottom of the vessel being heated. Thick-walled glassware (e.g., jars, bottles, cylinders, and filter flasks) should never be heated on hot plates.

- When using a hot/stir plate, ensure that only the settings necessary are activated (i.e., if you do not intend to heat, ensure the hot plate is NOT turned on).

8.0 Cleaning and Drying Glassware

Good lab technique necessitates the use of clean glassware. Glass must be physically clean, chemically clean, and in many cases, sterile. Many glassware accidents occur during cleaning. Some reminders when washing and drying glassware.

- Eye protection and heavy-duty slip-resistant and chemically resistant gloves should be worn when washing glassware.

- Wash glassware as quickly as possible after use. The longer it is left unwashed, the harder it will be to clean. If necessary, allow harder-to-clean apparatus to soak in soapy water.

- Do not overload sinks, dishwashers, or soaking bins.

- Keep glassware clear of the sides of the sink. Rubber sinks and counter mats can also help reduce the risk of breakage and injury.

- Never use worn-out cleaning brushes; they can scratch or abrade the glass.

- Specialized training in the safe usage of caustic cleaning agents must be completed before using aqua-regia, chromic acid, or other reactive solutions to clean glassware.

- When drying glassware, place articles on towels, lined baskets, or slip-resistant pads. Be sure to place it away from the edge of the bench. Large containers may be hung on pegs to dry.

- When cleaning pipettes, place pipettes, and tips down, into a cylinder or tall jar of water or appropriate disinfectant (e.g., for biologically contaminated tips). A pad of cotton or glass wool at the bottom will help prevent breakage of the tips. Ensure the water or disinfectant level is high enough to immerse the pipettes.

- New glassware should be washed before use to remove any residue or loose particles.