**Ugberase ehinomen nicholette**

**16/mhs06/069**

**Laboratory glassware** refers to a variety of equipment, traditionally made of [glass](https://en.wikipedia.org/wiki/Glass), used for [scientific experiments](https://en.wikipedia.org/wiki/Scientific_experiment) and other work in [science](https://en.wikipedia.org/wiki/Science), especially in [chemistry](https://en.wikipedia.org/wiki/Chemistry) and [biology](https://en.wikipedia.org/wiki/Biology) [laboratories](https://en.wikipedia.org/wiki/Laboratory). Especially [borosilicate glass](https://en.wikipedia.org/wiki/Borosilicate_glass), pioneered by [Otto Schott](https://en.wikipedia.org/wiki/Otto_Schott), or sodalime glass are preferred glass types for scientific experiments and other work in science, especially in chemistry and biology laboratories.

Glass has a wide variety of functions which include volumetric measuring, holding or storing [chemicals](https://en.wikipedia.org/wiki/Chemical) or samples, mixing or preparing [solutions](https://en.wikipedia.org/wiki/Solution) or other mixtures, containing lab processes like [chemical reactions](https://en.wikipedia.org/wiki/Chemical_reaction), heating, cooling, [distillation](https://en.wikipedia.org/wiki/Distillation), separations including chromatography, synthesis, growing biological organisms, spectrophotometry, and containing a full or partial [vacuum](https://en.wikipedia.org/wiki/Vacuum), and pressure, like [pressure reactor](https://en.wikipedia.org/wiki/Pressure_reactor).

Laboratory glassware may be part of a sophisticated apparatus, as is the case with certain types of [condensers](https://en.wikipedia.org/wiki/Condenser_(laboratory)), and it may be used in conjunction with other [laboratory equipment](https://en.wikipedia.org/wiki/Laboratory_equipment) such as ring stands, burette clamps, and [bunsen burners](https://en.wikipedia.org/wiki/Bunsen_burner" \o "Bunsen burner).

**Heating reagents or samples**

Heating or cooling of most glassware must be done carefully because [thermal expansion](https://en.wikipedia.org/wiki/Thermal_expansion) in one portion of the glass but not an adjacent portion may put too much [mechanical stress](https://en.wikipedia.org/wiki/Stress_(mechanics)) on the surface and cause it to [fracture](https://en.wikipedia.org/wiki/Fracture). Fracturing is a concern when students new to laboratory become impatient and heat glassware, especially the larger pieces, too fast. Heating of glassware should be slowed using an insulating material, such as metal foil or wool, or specialized equipment such as [heated baths](https://en.wikipedia.org/wiki/Heated_bath), [heating mantles](https://en.wikipedia.org/wiki/Heating_mantle) or laboratory grade [hot plates](https://en.wikipedia.org/wiki/Hot_plate) to avoid fracturing.

Hot glass also looks exactly like cold glass, so care must be taken to avoid grabbing hot glassware.[[2]](https://en.wikipedia.org/wiki/Laboratory_glassware#cite_note-2)

**Negative pressure and vacuums**

A [bell jar](https://en.wikipedia.org/wiki/Bell_jar) operating below atmospheric pressure

An absolute [vacuum](https://en.wikipedia.org/wiki/Vacuum) produces a pressure difference of one atmosphere, approximately 14 psi, over the surface of the glass. The energy contained within an implosion is defined by the pressure difference and the volume evacuated. Flask volumes can change by orders of magnitude between experiments. Whenever working with liter sized or larger flasks, chemists should consider using a safety screen or the sash of a flow hood to protect them from shards of glass, should an implosion occur. Glassware can also be wrapped with spirals of tape to catch shards, or wrapped with webbed mesh more commonly seen on [scuba](https://en.wikipedia.org/wiki/Scuba_set) cylinders.

Glass under vacuum becomes more sensitive to chips and scratches in its surface, as these form strain accumulation points, so older glass is best avoided if possible. Impacts to the glass and thermally induced stresses are also concerns under vacuum. [Round bottom flasks](https://en.wikipedia.org/wiki/Round_bottom_flasks) more effectively spread the stress across their surfaces, and are therefore safer when working under vacuum.

When connecting glassware, it is often tempting to use [Keck clips](https://en.wikipedia.org/wiki/Keck_clip) on every joint, but this can be dangerous if the system is sealed or the exhaust is in any way restricted; e.g. by wash flasks or drying media. Many reactions and forms of operation can produce sudden, unexpected surges of pressure inside the glass. If the system is sealed or restricted, this can blow the glass apart. It is safer to only clip the joints that need holding together to stop them falling apart and to purposefully leave one or more unclipped; preferably those that are connected to lightweight, small objects like stoppers, thermometers or wash heads, that are pointing vertically upwards and not connected to other items of glassware. By doing so, any significant surge of pressure will cause these specifically chosen tapers to open and vent. This may seem counterintuitive, but it is safer and easier to deal with a controlled escape as opposed to the entire volume being uncontrollably released in an explosion.

**Hermetic sealing**

A [hermetic seal](https://en.wikipedia.org/wiki/Hermetic_sealing) is an air-tight seal. Sealing laboratory glassware in such a manner involves using [sealing tape](https://en.wikipedia.org/wiki/Thread_seal_tape) or [grease](https://en.wikipedia.org/wiki/Grease_(lubricant)) to get an airtight seal. This seal may be applied to the ground-glass joints to prevent the joint from seizing and to allow easy disassembly. [Silicone grease](https://en.wikipedia.org/wiki/Silicone_grease) used as a sealant and a lubricant for interconnecting [ground glass joints](https://en.wikipedia.org/wiki/Ground_glass_joint) allows a chemist to see when a joint is leaking, as bubbles can usually be seen flowing through the taper. When connecting joints, it is the responsibility of the chemist to select the correct seal for an experiment. For example, PTFE tape, bands, and fluoroether-based grease or oils may emit toxic [perfluoroisobutylene](https://en.wikipedia.org/wiki/Perfluoroisobutylene" \o "Perfluoroisobutylene) fumes if the rated temperature limits are exceed, which is possible in experiments involving heat.

**Cleaning**

There are many different methods of cleaning laboratory glassware. Most of the time, these methods[[5]](https://en.wikipedia.org/wiki/Laboratory_glassware#cite_note-5)[[6]](https://en.wikipedia.org/wiki/Laboratory_glassware#cite_note-grasshopper-6) are tried in this order:

* A detergent solution may be used to soak glassware. This removes grease and loosens most contamination.
* Scrubbing with a brush or scouring pad is a mechanical means of removing gross contamination and large particles.
* [Sonicating](https://en.wikipedia.org/wiki/Sonication) the glassware in a hot detergent solution is an alternative to both a detergent solution and scrubbing.
* Solvents, such as mild acids, known to dissolve a specific contamination may be used to remove trace quantities.
* [Acetone](https://en.wikipedia.org/wiki/Acetone) may be used for a final rinse of sensitive or urgently needed glassware as the solvent is [miscible](https://en.wikipedia.org/wiki/Miscible) with water, and helps dilute and wash away remaining water from the glassware.
* Glassware is often dried by suspending it upside down to drip dry on racks; these can include a hot air fan to blow the internals dry. Another alternative is to place the glassware under vacuum, lower the boiling points of the remaining volatiles.
* For special type of precipitates, aqua regia (concentrated HCl: HNO3 at 3:1 ratio) is used.

**Disposal**

Typically broken glassware must be disposed of separately because shattered glass may be sharp.