Laboratory ware

- ✓ Classified as plastic-wares, glass-wares, ceramics and platinum-wares

Glass-wares

- ✓ Widely used in the laboratory such as measuring volumes, heating and storage of solutions, etc.
- ✓ Glass-wares withstands high temperatures depending on composition and extent of annealing
- ✓ Glass-wares are classified into class A, B, C&D
- ✓ Class A has the highest accuracy and they are expensive.
- ✓ They are classifies into 4 categories:
    - o General glass-wares e.g. beakers, flasks etc.
    - o Volumetric glass-wares e.g. pipettes, biuretts, volumetric flasks etc.
    - o Special glass-wares
    - o Jointed glass-wares

Plastic-wares

- ✓ They are also commonly used in the laboratory for measuring volumes, storage of solutions etc.
- ✓ Cannot be used for heating solutions since can't withstand high temperatures.

Platinum -wares

They are either silica or nickle

General glass-ware cleaning

- ✓ Laboratory glasswares have to be perfectly clean before it can be used for any type of analytical work.
- ✓ There are two reasons for that. First, you don't want any remaining reagents on the glass surface - they could react with your solutions and change analysis results.
- ✓ Second, if the glass is not perfectly clean, water will not wet its surface, and it will be present on the glass surface in the form of droplets:
- ✓ It is impossible to account for volume of these droplets, so you will never know what volume of the reagent was used
- ✓ Also the precision of the volume measurements is the basis of the precision of the volumetric methods, dirty volumetric glass means huge errors.
- ✓ Cleaning is very important since it will help the individual to carry out the experiments in a free contaminated apparatus.
- ✓ After cleaning, dry oven drying is not recommended for certain glass-wares due to an even expansion and contraction which leads to error in measurements of volumes.
- ✓ All glass-wares should be chemically clean and free from grease.
- ✓ Best cleaning method is achieved immediately after use since:
    - It saves on energy in cleaning.
    - Saves on detergent
    - Most reagents can be easily removed by simple rinsing as long as their solution has not dried on the glass surface.
- ✓ There are many different methods of cleaning laboratory glassware. Most of the time, these methods 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** 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** is may be used for a final rinse of sensitive or urgently needed glassware as the solvent is 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.

- ✓ There are also cleaning solutions that can be prepared in the lab. These are usually highly corrosive and based on strong oxidizing agents (Piranha solution, chromic acid solution) or strong hydrolyzing agents (NaOH ethanol solution).
- ✓ They should be used with care as they can be dangerous, especially Piranha solution can be unpredictable and explode in the presence of organic contaminants.
- ✓ In some cases they can also damage graduation markings on the glass.
- ✓ After cleaning with a detergent or special solution, rinse the glass thoroughly with a tap water.
- ✓ After that rinse with distilled or De-Ionized water.
- ✓ When rinsing with distilled or DI water, rinse 3-4 times.
- ✓ Each rinsing dilutes whatever was present on the glass, so it is better to rinse three times with small volumes of DI water, then to rinse once with a large volume (this is similar to basic idea behind the extraction technique).
- ✓ Be sure you have rinsed whole glass surface.
- ✓ Don't dry the glass surface with towels; just leave it protected from the dust.
- ✓ It is not necessary to dry the glass in the lab dryer, but if you have one - use it.
- ✓ Not only will it dry the glass faster, but it will also keep the glass protected from the dust during drying.
- ✓ Drying can involve use of Acetone, drip drying, use of oven or drying at room temperature.
- ✓ Remember to keep the glass in locker when not in use, to avoid air pollution. In the case of burettes we may cover them with paper caps to keep them clean:

Dichromate Acid Cleaning Solution

1. Dissolve 400g of potassium dichromate in in 4L distilled water.
2. Slowly add 400ml of sulfuric acid.
3. To use, add to glassware for several minutes and rinse with copious amounts of water.

Note: Keeps until solution turns dark brown

Caution: Postasium dichromate is toxic by inhalation and ingestion. Sulfuric acid is caustic. Use personal protective equipment, prepare under hood in a well ventilated area. Consult with appropriate safety officials at your institution for proper procedures and disposal.

- ✓ Allow glassware to remain in contact with this solution for a period of not less than 24 hours when used at room temperature. A shorter period is adequate if heat is applied.
- ✓ After sometimes of using chromic acid, the color changes and this means that the oxidizing power is low and a fresh preparation should be made.
- ✓ Other oxidizing preparation is (aqua regia – a mixture of nitric acid/hydrochloric acid mixture) used in the ratio of 1:3

Aqua regia

- ✓ **Aqua regia** (“royal water"), ***aqua regis*** ("king's water"), or **nitro-hydrochloric acid** is a highly corrosive mixture of acids, a fuming yellow or red solution.
- ✓ The mixture is formed by freshly mixing concentrated nitric acid and hydrochloric acid, usually in a volume ratio of 1:3.
- ✓ It is also used in some laboratories to clean glassware of organic compounds and metal particles.
- ✓ This method is preferred over the "traditional" chromic acid bath for cleaning tubes, because no traces of paramagnetic chromium can remain to later spoil acquired spectra.
- ✓ While chromic acid baths are discouraged because of the high toxicity of chromium and the potential for explosions, **aqua regia** is itself very corrosive and has been implicated in several explosions due to mishandling.
- ✓ Due to the reaction between its components resulting in its decomposition, **aqua regia** quickly loses its effectiveness (yet remains a strong acid), so its components are usually only mixed immediately before use.
- ✓ Upon mixing of concentrated hydrochloric acid and concentrated nitric acid, chemical reactions occur.
- ✓ These reactions result in the volatile products **nitrosyl chloride** and **chlorine** as evidenced by the fuming nature and characteristic yellow color of aqua regia.

Quickfit apparatus

- ✓ These are jointed glass wares.
- ✓ They break easily when disconnecting joints
- ✓ This is prevented by use of a lubricant such as Vaseline or any other hydrocarbon lubricants
- ✓ Sticking quickfit sets are removed by:
    - o Gently tapping when placed on a wooden bench using your finger or wooden stick
    - o Use of oil solution
    - o Use of warm water or boiling water
    - o Heating directly using burners

How to Clean Crucibles

- ✓ Once you are done conducting your experiments, you need to know how to clean your crucibles effectively and without causing damage to the crucible surface so it can be used again.
- ✓ Cleaning chemicals from porcelain crucibles or alloy residue from platinum ones is relatively easy.
- ✓ Gently scrape as much residue left from the materials used in your experiment from the crucible.
- ✓ Fill your porcelain or platinum crucible with fused potassium bicarbonate; this chemical will be in a solid form.
- ✓ You should have enough bicarbonate in the crucible to fill past the line of the remaining material from your experiments. If you need to fill the entire crucible, do so.
- ✓ Place the crucible on a burner. Heat the crucible until the fused bicarbonate melts.
- ✓ Heat it until a layer of red potassium salt appears on the surface.
- ✓ Using a mixing rod, stir the melt a few times. The entire melting procedure should take about one minute.
- ✓ Remove your crucible from the flame. Pour out the melt.
- ✓ If your crucible is platinum, submerge it in a boiling glass bath of hydrochloric acid (a 20% mix to water) for three minutes.
- ✓ Rinse the crucible in hot water. For porcelain crucibles, use a clean cloth to dry the surface.
- ✓ If your crucible is platinum, use alumina-impregnated nylon webbing to complete cleaning the surface.
- ✓ Let the crucible cool.

Use & Care of Platinum Labware

Platinum (Pt) and many of its alloys are highly resistant to chemical attack. To get the greatest use and life out of your Pt ware you should observe the following:

- Avoid thermal and physical shock.
- Cleaning: For routine operation, place the Pt labware into a beaker of hot citric acid solution (concentration and temperature to suit).

Other cleaning operations include:

- ✓ Boiling with dilute hydrochloric acid (HCl) or fusing with potassium bisulphate prior to boiling with water normally suffices
- ✓ For a more aggressive clean, boil in nitric acid (HNO3 chlorine free).
- ✓ Whatever cleaning method is used, rinse thoroughly with clean water and dry thoroughly.

- Polish and reshape your Pt ware after use.
- Always maintain oxidizing condition.
- Avoid contact with most metals, e.g. Fe, Cr, Ni, Cu, Zn, Pb – particularly at elevated temperatures. If the metal particles are fine enough, they can be pre-oxidized as above.
- Do not carry out direct fusions with caustic alkalis, nitrates, cyanides or nitrides in Pt ware.
- Barium and lithium hydroxides react at red heat with platinum and fused alkali oxides and peroxides dissolve platinum.
- In general, reduce handling as much as possible. Ideally the Pt ware should only come in contact with tongs (titanium or Pt tipped steel tongs), balance pan and cradle used to hold the Pt ware.
- Never place Pt ware on bench tops.

Ceramics

A **ceramic** is an inorganic, nonmetallic solid prepared by the action of heat and subsequent cooling.
The earliest ceramics were pottery

Types of ceramic products

Structural, including bricks, pipes, floor and roof tiles

They includ:-

- o Earthenware, which is often made from clay, quartz and feldspar.
- o Stoneware
- o Porcelain,

- ✓ They are cheap
- ✓ Have the ability to withstand high temparatures
- ✓ They are brittle

Cleaning of ceramics

- ✓ Some antique ceramics contain fragile painted or gilded surface decoration which can be removed or damaged by harsh cleaning solutions.
- ✓ It is important to use only dilute cleaning solutions, applied with soft cloths during cleaning.
- ✓ Antique ceramics should never be soaked in any liquid.
- ✓ Prolonged soaking and uneven drying can lead to staining of ceramics.
- ✓ This is particularly probable in items that are chipped, scratched or that have cracked glazes.
- ✓ Lastly, automatic dishwashers should never be used to clean antique ceramics.
- ✓ Recommended materials for cleaning ceramic objects include mild detergents in water.
- ✓ Boiling aqua regia or caustic soda solution can be used for washing
- ✓ Follow with hot water with soap detergent then rinse with distilled water.

Sintered glassware

- ✓ Sintered glassware is used for the filtration of liquids and gases in the laboratory.
- ✓ It incorporates a porous glass disc as a filter media, which is non corrosive and reusable.

CLEANING OF SINTERED WARE

1. New sintered filters should be washed carefully with hot hydrochloric acid and then rinsed with distilled water before they are used. This treatment will ensure that all loose particles are removed from the filter.
2 It is recommended that all sintered filters are thoroughly cleaned "immediately" after use. This is the most favorable time for ease of cleaning and will ensure less risk of contamination in subsequent use.
3. Many precipitates can be removed from the filter by backflushing with water. However, great care must be taken with large diameters and fine filters, as positive pressures on the reverse side may break the filter.
4. Under no circumstances, should sintered apparatus be subjected to mains water pressure when back flushing as in most instances this will lead to fractured filters.
5. Drawing water through the filter from the reverse side with a vacuum pump is also effective.
6. Filters clogged by dust and dirt during gas filtration can be restored by treatment with a warm detergent solution followed by blowing through clean air from the clean side of the filter. Dirt particles are brought to the surface by the foam and removed by rinsing with water.
7. Some precipitates may clog the filter which may be removed by chemical cleaning as given below :

- *Fats and grease :* Carbon tetrachloride or suitable organic solvent.
- *Albumen, Glucose :* Hot ammonia or hydrochloric acid, mixture of hot concentrated sulphuric and nitric acids.
- *Organic substances :* 'Chromic' acid cleaning solution* or concentrated sulphuric acid containing a little potassium nitrate or Perchlorate (0.5%) (possibly need to soak overnight)
- *Copper or iron oxide :* Hot concentrated hydrochloric acid with potassium chlorate.
- *Barium sulphate :* Hot concentrated sulphuric acid
- *Mercury Residues :* Hot concentrate nitric acid
- *Mercury Sulphide :* Hot aqua regia

NB: Present of slight amount of any organic or inorganic material causes a lot of change in the results of chemical tests that are performed. This includes:-

- ✓ Presence of traces of **physiological saline** in glass-wares raises the results of Na^+ and Cl^- estimation
- ✓ Presence of traces of **blood** in glassware gives a false positive test for occult blood
- ✓ Presence of **grease** interferes with volumetric analysis due to air-bubbles formation
- ✓ Presence of certain **detergent** may cause hemolysis which invalidates biochemical tests such as estimation of plasma or serum phosphorus, phosphates and potassium.

Cleaning of Pipettes

- ✓ Pipettes should be rinsed immediately after use in running water.
- ✓ They should be steeped in the washer with tip facing upwards to avoid being chipped or clogged
- ✓ They are then soaked in soapy water and rinsed several times in tap water.
- ✓ Passing a stream of water from water pump quickens washing then rinsed 3 times.
- ✓ Greasy pipettes should be steeped in a container containing dichromate cleaning solution then left overnight.
- ✓ Rinse in distilled water then hot air dry.
- ✓ When cool, keep them in cloth lined drawers to avoid mechanical breakages.
- ✓ Blood dilution pipets can be washed by flushing water and acetone through them.
- ✓ Ordinary household bleach can be used to remove blood clots in the bore of pipets.

Cleaning of a clogged Wintrobe

A method of cleaning small bore tubes and pipettes (such as Wintrobe sedimentation rate tubes) is to attach a capillary pipette, by a rubber hose, to a water type suction pump. Attach the tube to the flat end of the pipette and hold the tube under water. Blood is drawn from the tube as water is drawn in.

When the tube is clean, invert the tube, remove the residual water by suction, and allow drying. Occasionally, the tube should be cleaned with dilute sodium hypochlorite (household bleach) to remove deposits of residual blood.

- ✓ Alternatively, fill wintrobe with mild detergent, with the help of a Pasteur pipette. Detergent hemolysis rbc immediately.
- ✓ After immersing in the detergent for a while, hold the beaker under running tap water
- ✓ The tube will be fairly clean
- ✓ Use Pasteur pipette to empty the contents.

For glass-ware contaminated with infectious agents

- ✓ First disinfect with 5%phenol before cleaning
- ✓ Alternatively boil the glassware with disinfectant for 30min
- ✓ For glassware used in microbiology, sterilize by autoclaving before re-using (chemical cleaning not necessary)
- ✓ Containers holding sputum specimen, autoclave for 30min.

Storage of cleaned glassware

- Glass-wares after being cleaned, they should be stored in a dust free area
- During storage, the following should be considered:-
    - Labeling
    - Position of storage
    - Mode of storage.

Storage of pipette

- Stored in drawers lined with soft padding material. E.g, cotton wool
- Arranged to sizes and the drawer should be labeled

Storage of Beakers

- Stored upside down in a cupboard or shelves
- Base is lined with blotting paper then shelves labeled.

Storage of rods

- Stored horizontally well supported to prevent rolling.

Storage of Biurettes

- Stored in a cupboard fixed in a retort stand with the tip covered with a small beaker