

# Glass Working Lab

1. Read the rest of this document carefully BEFORE beginning this lab. Be sure to pay special attention to the safety notes.
2. You will be making the following pieces of glassware:
  - (a) 6" piece of straight glass tubing with both ends fire-polished
  - (b) Take the same piece of glassware from (a) above and make a 90° bend
  - (c) 2 capillary pipette tubes
3. *Procedural note:* You may wish to use both a Bunsen burner and a Fisher burner for this lab. Fire polishing and making capillary tubing works best with the Bunsen burner while the Fisher burner works best for making the 90° bend.
4. As you complete EACH of the 3 pieces above, take them to your teacher for approval. Once you have gotten approval, you may then proceed to make the next piece.

## Safety when working with glass:

Burns and cuts are a possibility when working with glass. Use common-sense and keep your work area clean and free of excess and unused material. If you have someone working next to you stay centered at your glassblowing bench and be aware of all activity in your immediate area. Know the location of exits, fire alarms, telephone, fire extinguishers, safety and first-aid equipment, and gas shut-off valves. **Always wear appropriate protective clothing and/or equipment.** Inspect the entire work area, especially the gas supply system, to confirm safe working conditions. Do not work alone - be sure someone is close by to offer assistance if necessary.

## Cutting glass:

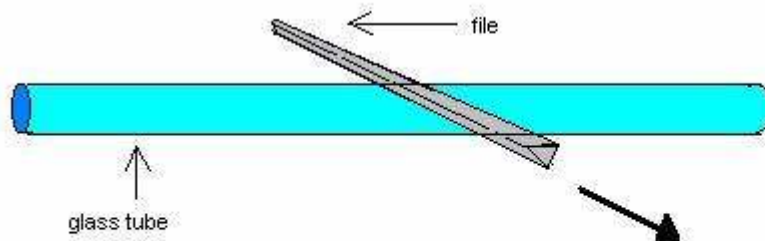
Glass tubing and rod come in four (4) foot lengths and metric diameters. Four feet of tubing is rather awkward to handle in the flame so we need to cut it down to a manageable size. Select tubing of 10 mm OD and place on a flat surface.

### Option #1

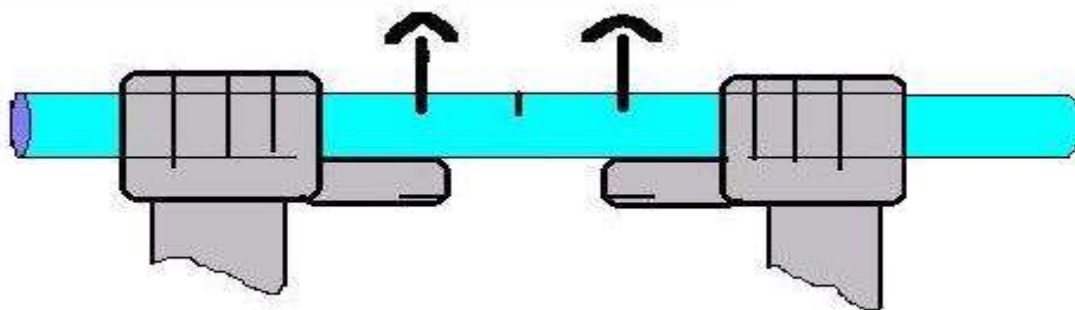
1. Create a scratch on the glass wall surface by drawing the **corner** of a file or tungsten carbide knife perpendicularly across the tube.



**Tip: Do this step once** creating a scratch approximately 1/8 inch long. **Do not saw the glass.** Sawing the glass will not make the process of breaking the glass any easier. It is not necessary to make a long scratch. A short, single sharp scratch is more likely to produce a clean even edge.



2. Pick up the glass tube and wet (water, saliva) the scratch with your finger. Turn the scratch away from your body.
3. Place your thumbs on the glass tube. **The scratch should be located between the thumbs but on the opposite side of the tube.**
4. Push your thumbs away from you. The glass tube should break cleanly at the scratch.



<http://www.ecu.edu/chem/glassblowing/gb.htm#cutting>


## Fire Polishing:

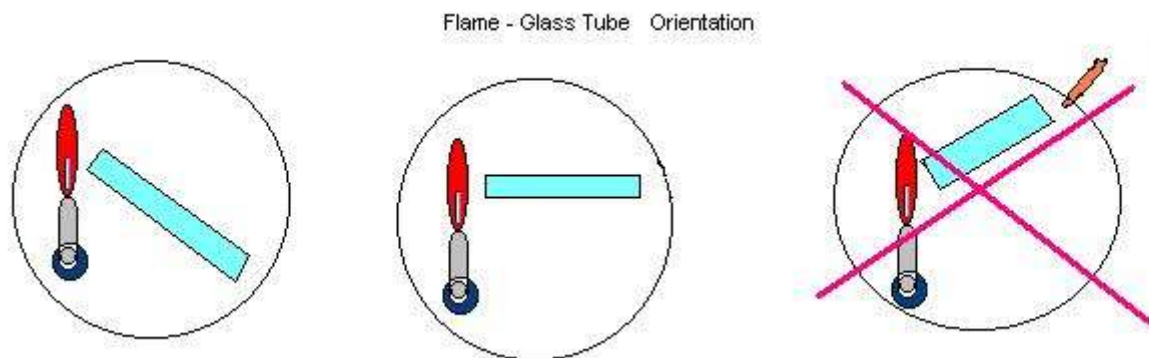
Fire polishing the ends of glass tubing and rod will seal small cracks in the end wall, reducing the chance of fractures originating from this source. Fire polishing ends will also reduce cuts and abrasions to you or anything (corks, latex tubing, etc.) coming in contact with the glass end.

1. Cut 10 mm tubing into 4 inch lengths (or use tubing from previous lesson).
2. Light and adjust torch flame (sharp/soft).
3. Fire polish by rotating the glass tube end in the flame.

A good fire polish has a smooth finish and the ID and OD of the glass tube remains unchanged.



 **Tip:** Hold the glass tube in a declining or horizontal position with the tube end angled away from you. This will prevent the flame from traveling up the tube and out the far end, possibly resulting in a burn.



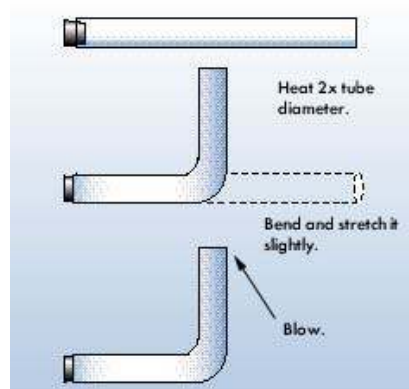
<http://www.ecu.edu/chem/glassblowing/gb.htm#firepolish>

## The Basics of Glass Bending

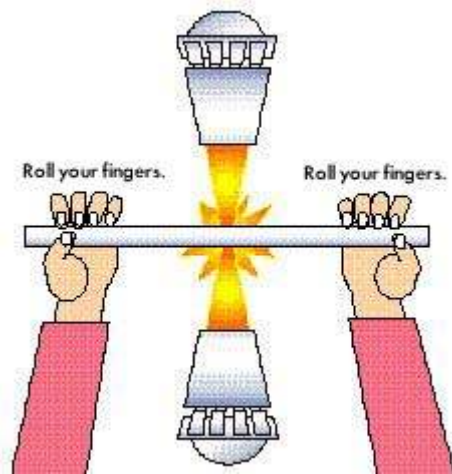
### Right-angle bend

#### Figure 1: Steps to make a basic angle bend

The most basic bend is the right-angle bend. The key to making a good bend is to heat sufficient glass to make the bend, and also to prevent kinking of the glass. For a right-angle bend, mark the glass tube so that the portion of the surface placed into the fire equals two full diameters of the tube. For example, if 12mm tubing is to be bent, small marks should be made on the tube 12mm in either direction

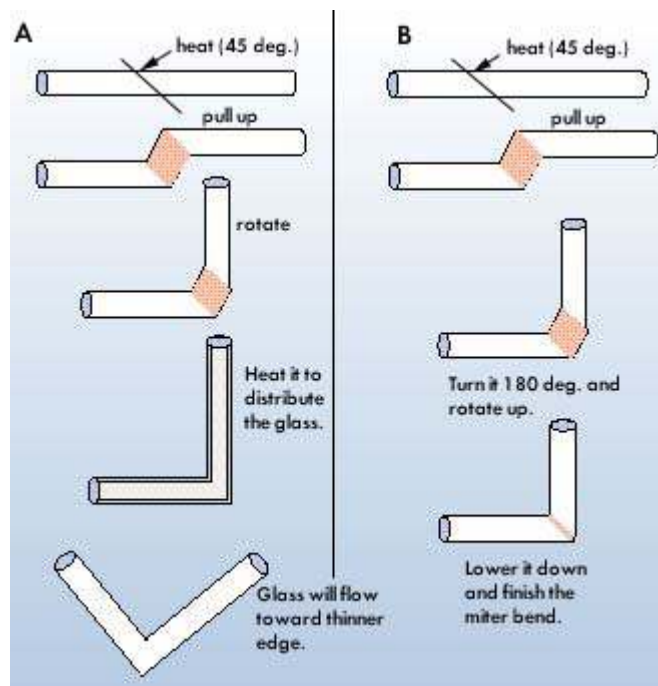


from the center of the bend, creating a heating zone of 24mm (Fig. 1).



**Figure 2: Hold the glass tubing in the crossfires**

Heat the glass in the crossfire, moving it back and forth uniformly while rotating the tube (Fig. 2). As the glass softens, balance the ends of the tube in your hands to prevent twisting or stretching of the glass. Before making the bend, raise the tube higher in the fire to apply more heat on the bottom, which will be the outside of the bend. Next, bend the ends of the tube upwards.

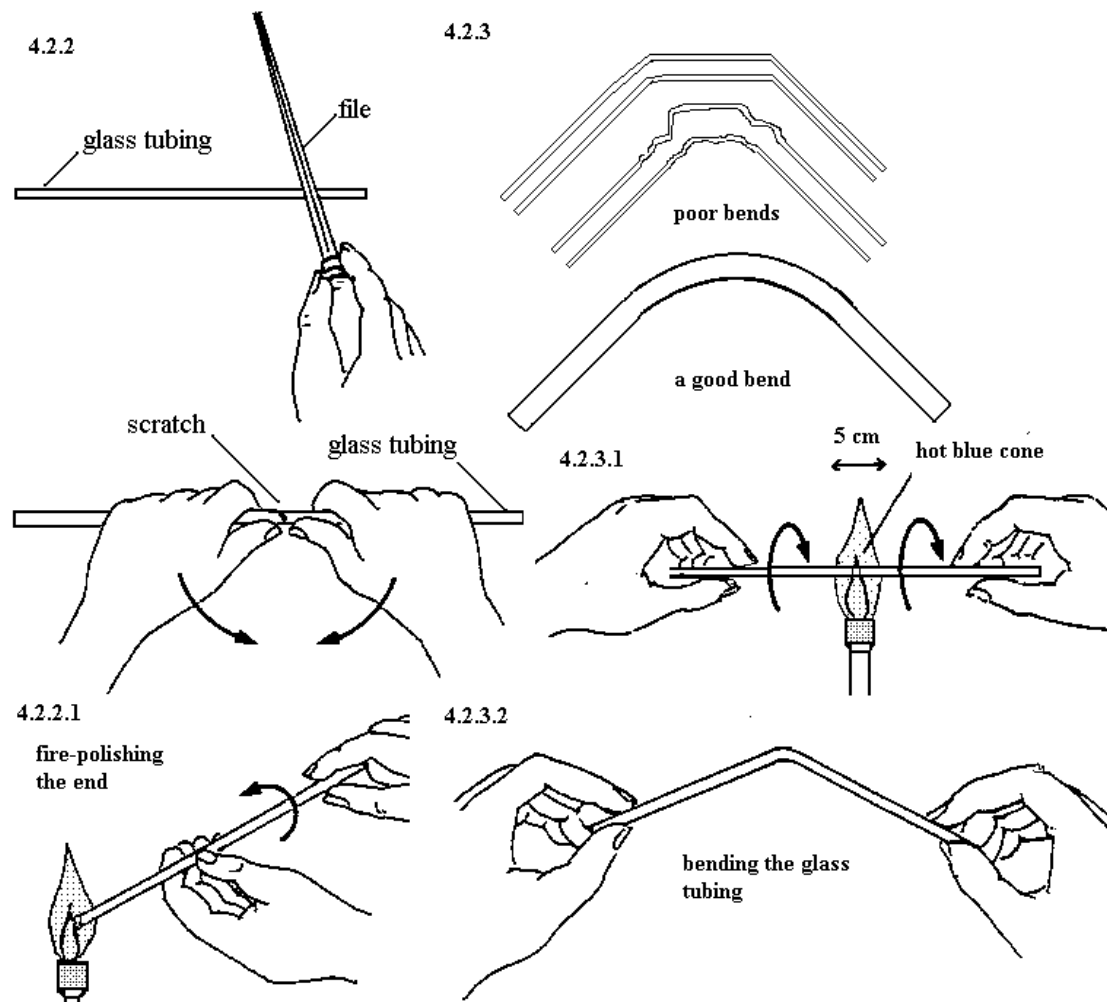


**Figure 3: A. Bending a right angle using the method at left is fairly easy to learn, but the skills needed to flow the glass back into uniform wall thickness can take longer to master. B. This hybrid method is the easiest for making sharp, clean crossovers. Both methods can only be deployed on uncoated tubes.**

A second method for making right-angle bends is the miter bend technique (Fig. 3). This method is used on uncoated tubing in countries where tubes are coated after bending is completed. Heat a

ring of glass on a 45° angle to the line of the tube. When soft, one side of the tube is pulled upward while keeping the two sides parallel. Pull up the raised portion of the tube to form a right angle while strongly heating the glass in the area of the joint to redistribute the glass and even out the walls of the bend. With practice, this bend produces a sharp, mitred, right-angle bend.

<http://www.signweb.com/neon/cont/glassbndg.html>



## Making a capillary dropper pipette tube:

1. Use a piece of glass about 6 inches long.
2. Fire polish both ends.
3. While CONTINUALLY rotating the piece of glass, use the Fisher burner to heat up the middle of the tube while holding each end with each hand.
4. When the glass is soft, gently but firmly pull the glass tubing apart – being careful to NOT bend the glass – hold it straight.
5. When the glass has cooled (takes only a short time), use the file to cut the skinny area in the middle. You now should have two dropper pipettes!