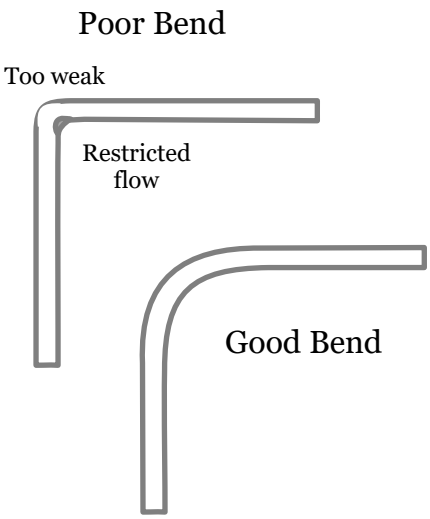
BISHOP LUDDEN *Chemistry* Name: _____

Section _____ GLASS BENDING LAB Date: _____

Glassware Bending Lab #7

Pre-Lab Discussion:

Chemical apparatus is often composed of many pieces of glassware connected with tubing. Usually, two pieces of glass tubing are connected by a short length of rubber tubing. It is possible to cut and bend glass tubing but the cutting process leaves dangerously sharp edges at the end of the tube. Inserting the glass tubing into rubber stoppers or rubber tubing connectors requires that the edges of the glass be smooth, not sharp. Heating the ends of the tubing in a burner flame will cause the glass to melt and form a smooth, rounded edge, a process known as *fire polishing*.



Glass bends that form too sharp an angle will have very thin glass walls on the outside edge of the bend. Furthermore, the inside edge builds up an excess of glass that restricts flow inside the tube. Finally, reshaping glass causes stress that weakens the glass and can lead to breakage. Heating the glass to just below the melting or flow point and cooling very slowly will relieve the stress and make a stronger and safer piece of glass. This heating and slow cooling process is known as *annealing* the glass.

Research Question:

How is glass tubing bent to make 90° bends and sharp glass ends fire polished to make them smooth and safe to use?

Materials:

Triangular file	glass tubing	glass rod	Tirrill burner
flame spreader	candle	ceramic pad	

Method:

Warning: use safety goggles whenever cutting glass tubing or glass rod. Glass tube or rod are cut by making a score on one side of the glass with a triangular file. Place the tubing at the edge of a lab bench or table and draw the file across the glass once. Avoid a sawing motion. Pick up the glass with both hands holding the tubing near your body with the score facing away from you and between your thumbs. Straighten your arms pushing the tubing away from you. Practice should result in a clean break with no shattering. Each lab partner should cut two pieces of glass. Cut two 18 cm lengths of glass tubing, one 25 cm length of glass tubing, and one 18 cm length of glass rod.

Caution: hot glass will remain hot forever. Placing hot glassware on a cold bench can result in cracking or shattering; and heating wet glass or wetting hot glass will result in shattering. Never take glass directly from a flame and set it on a cooling pad. Hold the glass in the air for at least 30 seconds to allow the glass to cool from 1000°C to about 500°C before placing it on a ceramic pad. Glass at 500°C will still cause third degree burns. To prevent burns, write the time and then set the glass on a ceramic pad for at least seven minutes before touching it again.

Fire polish both ends of all four pieces of glass. Hold the tubing at a 45° to 60° angle so that the end to be polished is in the hottest part of the burner flame. Constantly rotate the glass heating only the end to be polished. A yellow color imparted to the flame indicates that the glass is beginning to melt. Avoid heating glass tubing too long; it will tend to close the ends of the tube. Fire polishing glass rod often requires more time. To prevent ions from staying on the rod the end should be completely rounded and smooth.

Attach a flame spreader to the top of a burner barrel and then light the burner. Alternatively, use a Fischer burner to bend your glass tubing. Hold a piece of glass tubing to be bent at both ends. Heat as large an area as possible by rotating the glass to heat evenly. When the tube becomes quite soft, remove it from the flame and quickly bend it into a right angle. Carefully hold the tube in this position for 30 seconds until the glass hardens. Place the bend on a ceramic pad to cool. In a good bend, the inside diameter of the tubing will not be reduced or restricted at the bend. Bend one 18 cm tube and fire polish one 25 cm length of rod for a stirring rod.

Close the air intake openings on your Tirrill burner to obtain a slightly luminous tipped flame. Heat the tubing at the bend until the glass is just below the melting temperature. Have your lab partner adjust the burner barrel until the flame is strongly luminous but do not allow the glass to cool. Coat the bend area well with a thick layer of soot. Remove the glass from the flame and allow it to cool on a ceramic pad. As soon as the glass is cool, wipe the soot away with a paper towel.

Data Collection and Processing:

1. What color does soft glass impart to the flame when the glass begins to melt?
2. Have the lab instructor inspect your glass bend once annealed, cooled, and cleaned.
3. Have the lab instructor inspect your stirring rod once it has cooled.

Conclusions:

1. Describe the safe method of carrying long pieces of glass.
2. Describe the safe method of cutting glass tubing and glass rod.
3. Describe the safe method of handling hot glassware.
4. Why shouldn't you cool hot glassware with water?
5. Why must glassware be annealed?
6. When connecting separate pieces of apparatus, chemists avoid using long rubber tubing connectors whenever possible. Why is glass tubing preferred over rubber tubing?
7. Often, chemists will use a short rubber connector between two pieces of glass when making long connections between two pieces of equipment. What advantages does this have over using one long glass tube?
8. Why should sawing motions and multiple scoring be avoided when cutting glass?
9. What causes the yellow flame color when glass begins to melt?
10. What is the purpose of re-heating and coating glass bends with a layer of carbon soot?
11. In terms of KMT and chemical bonds, explain why heat softens glass so that it can be bent.

Applications

1. What did YOU (personally) learn?
2. How can any idea, principle, or activity in this lab be used in the real world?