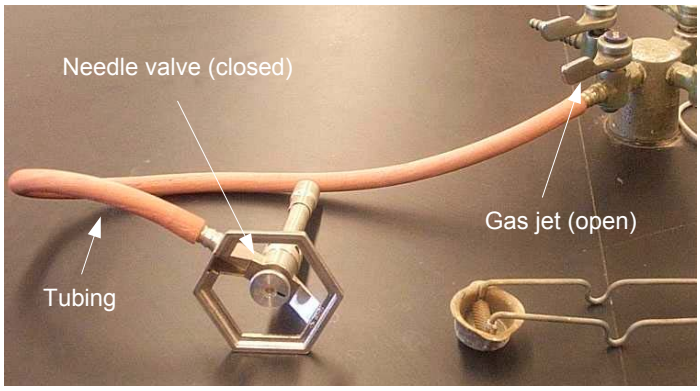
The Bunsen Burner

The Bunsen burner is the object most frequently associated with a chemistry laboratory. In this lab, it will serve as the primary heat source. The burner operates on natural gas, much like the burners of a gas stove. Take a moment to examine the burner; there are two parts to it: a tube (or barrel or stack) and a base. The tube screws onto the base. The drilled holes at the bottom end of the tube are air holes. There is a gas inlet at the top of the base. Natural gas and air mix in the tube, and this mixture is ignited at the top of the tube. Heat (and light) is liberated in the ensuing combustion reaction.

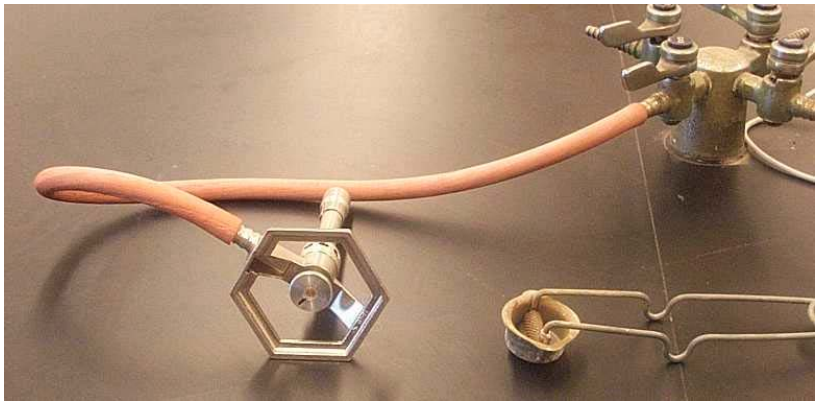
Burner stack and base (foreground), and fully assembled burner.

Burner operation is pretty straightforward, but before describing how to light a burner, let's examine its connections and controls. The burners in lab are attached to the house supply of gas by rubber tubing. (Inspect this tubing for cracks and tears; if the tubing is or becomes defective, request new tubing from your instructor.) Gas flow to the burner inlet is regulated at the gas jet to which the burner tubing is attached. The jet is closed when the handle above it is perpendicular to the jet. It is fully open when the handle is turned so that it is parallel to the jet. When the gas jet is opened, gas flows through the attached hose to the burner base. The amount of gas entering the burner tube is regulated by the needle valve at the base of the burner. If the valve is closed, gas flow is stopped. If the valve is open, gas will pass through the valve and travel up the burner tube.




Burner (bottom view) connected to gas supply. Note: the burner is on its side to show the needle valve. It is <u>not</u> ignited in this position.

The needle valve is opened/closed by turning the knurled knob (thumb wheel). Turn clockwise to close and counterclockwise to open. (Since you will frequently operate the needle valve with the burner in its normal upright position on the bench top (*i.e.* from above), to close turn counterclockwise from above and to open turn clockwise from above.)



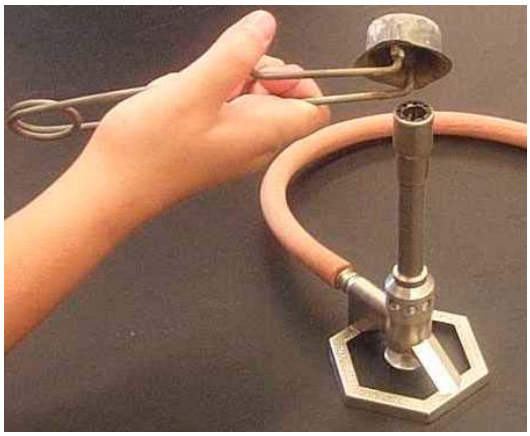
Bottom view of burner with needle valve partially open—compare black mark on thumb wheel in this and preceding picture. Note: the burner is on its side to show the needle valve. It is <u>not</u> ignited in this position.

Air is drawn into the burner tube by the flow of gas past the air holes. The amount of air drawn into the burner tube depends on the gas flow and size of the air holes. Air hole size is controlled by the extent to which the burner tube is screwed onto the base.

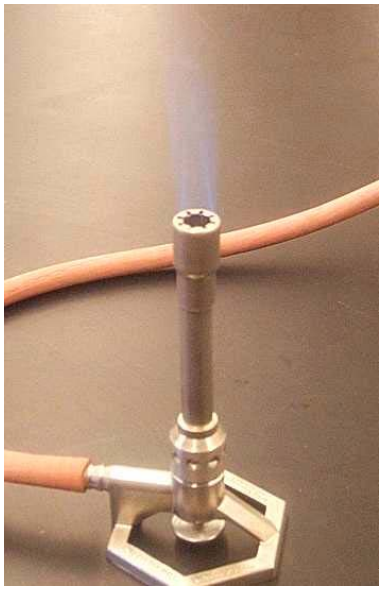
A striker (or match) is used to light the burner. Strikers are tethered to the bench tops. Before attempting to light a burner with a striker, check that it produces sparks readily. If it doesn't, check that a flint is installed and that it is not worn out. Replace missing or worn flints with a new flint – request one from your instructor.

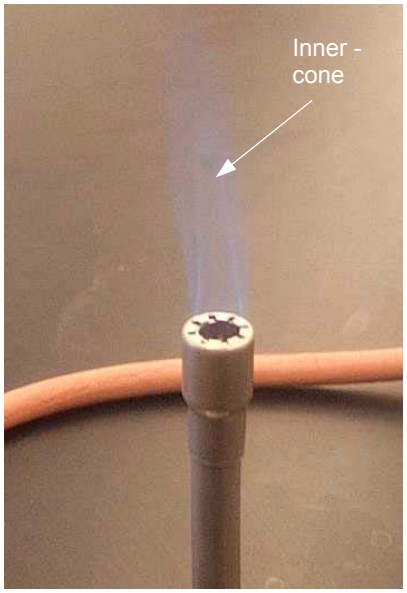
To light the burner, turn on the gas at the source – all the way. Open the needle valve approximately one-quarter to one-half turn. Bring the striker to the side and just above the top of the barrel. Hold it at a $45^{o}$ angle and strike. Repeat striking, if necessary. If the burner doesn't light after several strikes, turn the gas off at the source. Verify that you are generating sparks when striking the striker, and check that the barrel is all the way down and the needle valve is open by the specified amount. If these check out, the problem may be insufficient gas flow. Repeat the above steps but this time open the needle valve three-quarters to one full turn. Consult your instructor if you can't light the burner after several attempts.

Lighting the burner in this manner will result in a flame that is 1-2 inches tall. Normally a flame size of 3-5 inches is needed. Gas flow into the burner tube determines flame size. Adjust the needle valve until the desired size is obtained. CAUTION: too much gas flow can extinguish the flame. Since more gas is combusted when the gas flow is increased, more air is needed. To increase the amount of air drawn into the burner tube, unscrew it part way.



Flame temperature is also controlled by air flow into the burner tube. Less air produces a cooler flame; more air produces a hotter flame. Air flow is optimized by looking at the flame. A fuel-rich (cool) flame is yellow and sooty. An air-rich or fuel-lean (hot) flame is much more desirable. This condition is indicated by a flame that has an inner pale blue cone surrounded by an outer darker more translucent blue cone. Adjust the burner tube to produce a hot flame. CAUTION: too much air can extinguish the flame.






However, the temperature of a properly adjusted flame is not uniform. The hottest part of the flame is just above the top edge of the inner cone.

View movie illustrating proper techniques for lighting burner. (Requires QuickTime Player.)