8.1 Spectral emission tubes

Subjects: Atomic structure, electromagnetic radiation

Description: Display of atomic emission lamps containing different gases. Excitation of electrons in the gases result in emission of different wavelengths of light.

Materials:
H_2 emission tube with power supply**
Display board with several atomic emission tubes (H_2, Ar, Ne, He, Hg?)*
Tesla coil*
Spectroscopes or gratings

**Too large for bin. Located on the shelf above the bench.
*Shared item. Located in the drawer opposite the chemical storage cabinets.

Procedure:
1. Dim the lights in the room
2. For the H_2 emission tube: Plug in the power supply and turn on the lamp.
3. For the board with mounted tubes: Using the Tesla coil, activate each emission tube individually to show the emission spectra of certain gaseous elements or compounds.

Discussion:
When the lamps are charged with the Tesla coil, energy is transferred to the gases in the tube. This energy causes the electrons to be excited into higher energy states. As the electrons relax back to a lower energy state, a photon of light is emitted. The energy or wavelength of the photon is equal to the energy difference between the lower energy state and the excited state. Each element or compound has its own discreet energy levels and thus will emit their own characteristic wavelengths (colors) of light.

Safety:
Since this equipment requires high voltage, care should be exercised to avoid shocks. After using the Tesla coil, turn down the power and unplug. If left on, the Tesla coil can become hot and the risk of burns exists.

Disposal:
None

References:
1. NCSU Department of Chemistry Lecture demonstration website: http://www.ncsu.edu/project/chemistrydemos/DemoList.html