

8.3 Crooke's tube

Subject: Atomic emission, atomic structure, electrons

Description: A beam of electrons is produced in a Crooke's tube. A magnet is brought near one end of the tube and the electron beam is deflected into a bent line.

Materials:

Crooke's tube

Tesla coil*

Magnet

*Shared item. Located in the drawer opposite the chemical storage cabinets.

Procedure:

1. Dim the lights.
2. Plug in tesla coil.
3. Bring tesla coil to end of Crooke's tube to produce the electron beam.
4. Bring a horseshoe magnet close to the tube.
5. Observe deflection of electron beam.

Discussion:

A Crooke's tube is a cathode ray tube. Cathode rays are simply negatively charged particles, or electrons. Cathode-ray tubes contain a pair of metal plates sealed into a glass tube that has been partially evacuated. When a high voltage is applied, residual air in the tube is ionized. These ions are accelerated toward the cathode. The impact of the ions on the cathode metal surface releases electrons that are accelerated towards the anode. This is the electron beam or cathode ray. Some of the electrons miss the anode and hit the glass beyond. This impact excites the glass molecules, causing them to fluoresce. The glow on the glass indicates the direction of the beam by where the electrons impact the glass. The electron beam can be deflected by a magnetic field.

Safety: Use caution working with high voltages to prevent shocks.

References:

1. Purdue University Chemistry Demo Movie sheets:
http://chemed.chem.purdue.edu/demos/main_pages/6.1.html
2. Wikipedia: http://en.wikipedia.org/wiki/Crookes_tube