

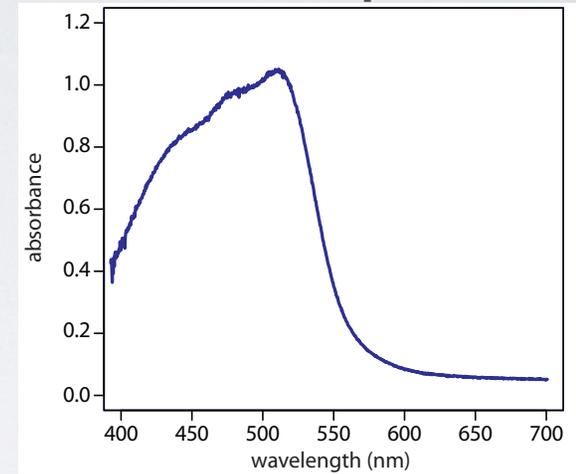
ATOMIC ABSORBANCE SPECTROSCOPY

SDSU CHEM 251

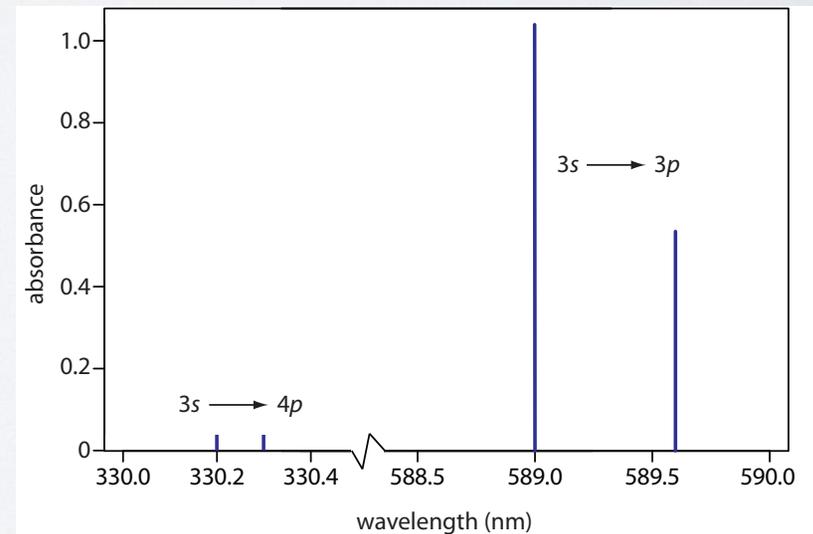
ATOMIC ABSORBANCE SPECTROSCOPY (AAS)

- AAS is similar to molecular absorbance spectroscopy, with the obvious distinction that **AAS is focused on atoms**, not molecules.
- As such, **samples are destroyed** in the process of the analysis, as they must be broken down to their component atoms.
- The benefit is that atoms have much more **limited, and specific absorbance spectra**, as compared to molecules, so more selective analyses can be made.

Iron-phenanthroline complex absorbance spectrum



Sodium absorbance spectrum



ATOMIZATION

- To decompose the analyte into individual atoms, the sample must be heated, a lot.
- Flame AAS instruments use a **nebulizer** to make tiny droplets of the **liquid sample**, before entering the **flame**.
- The light to be absorbed is passed along the length of the burner (10 cm path length).
- Flame AAS instruments consume large amounts of liquid sample for an analysis and only about 95% gets to the flame.

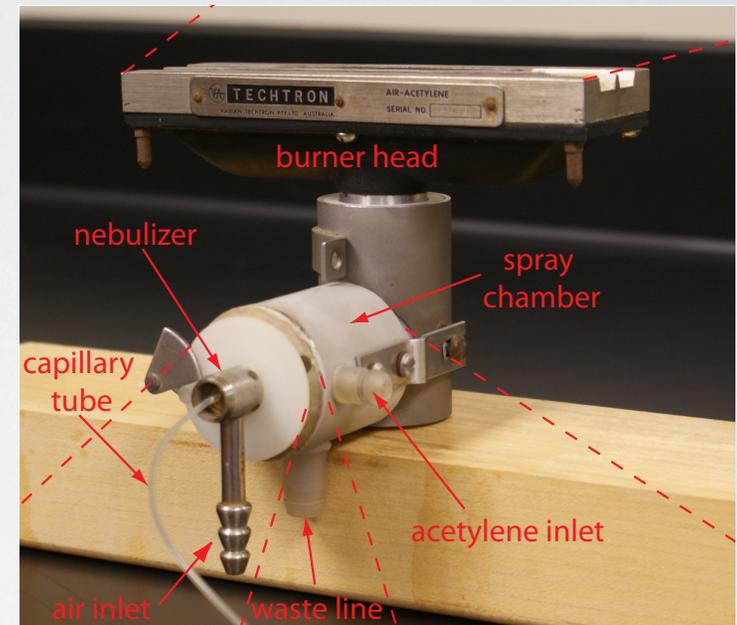
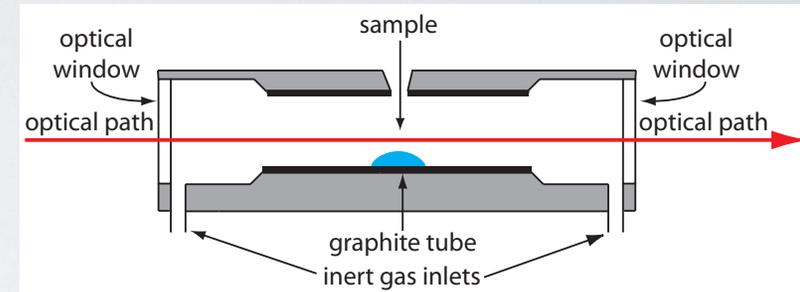


Table 10.9 Fuels and Oxidants Used for Flame Combustion

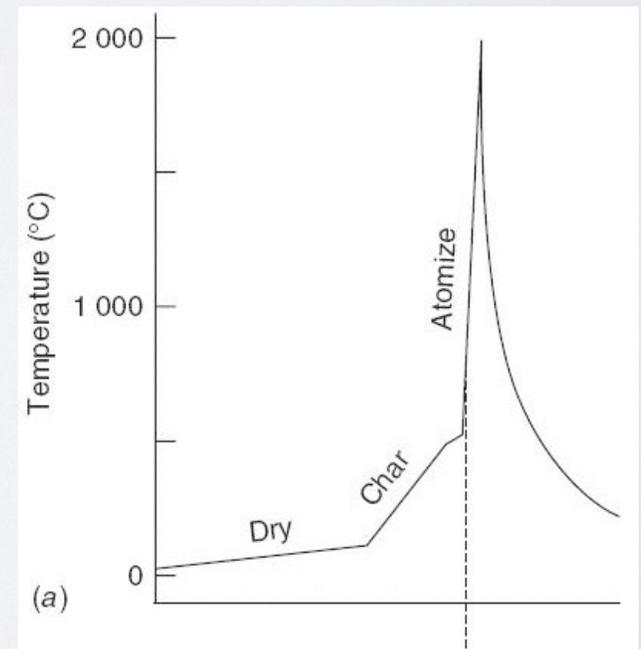
fuel	oxidant	temperature range (°C)
natural gas	air	1700–1900
hydrogen	air	2000–2100
acetylene	air	2100–2400
acetylene	nitrous oxide	2600–2800
acetylene	oxygen	3050–3150

ELECTROTHERMAL ATOMIZERS

- Electrothermal (graphite furnace) instruments do not use a flame, but rather **resistive heating** to atomize the sample.
- They can accommodate **solid** and **liquid** samples.
- Only take 5-50 μL of sample.
- Gasses can be purged from the furnace prior to final atomization.



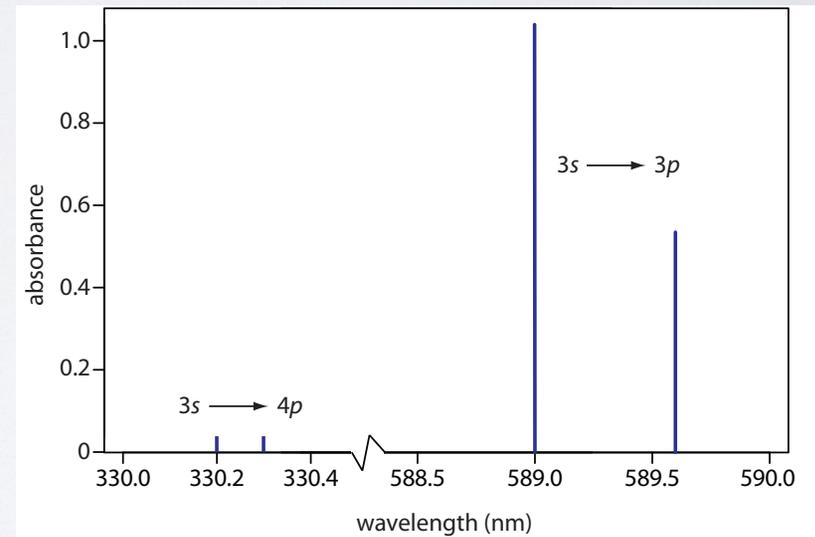
Temperature Program



LIGHT SOURCE

- As with all absorbance measurements a light source is required.
- Unlike molecular absorbance a regular light source will not suffice.
- Regular light sources, even with a monochromator, have too broad an emission spectra. This means the the atoms will not absorb enough light for it to be noticeable by the detector.

Sodium absorbance spectrum



HOLLOW CATHODE LAMP

- **Hollow cathode lamps** are specialized lamps made from the metal of interest for the analysis.
- They emit light is **narrower in wavelength** than what the atoms will absorb. This is because the atoms in the lamp are colder than the atoms in the flame or furnace.
- This ensures that if an atom can absorb the light it will, but **a different lamp is needed for each element to be analyzed.**

