Chapter 9:

Atomic Absorption and Atomic Fluorescence Spectrometry

9 A- Sample Atomization Techniques

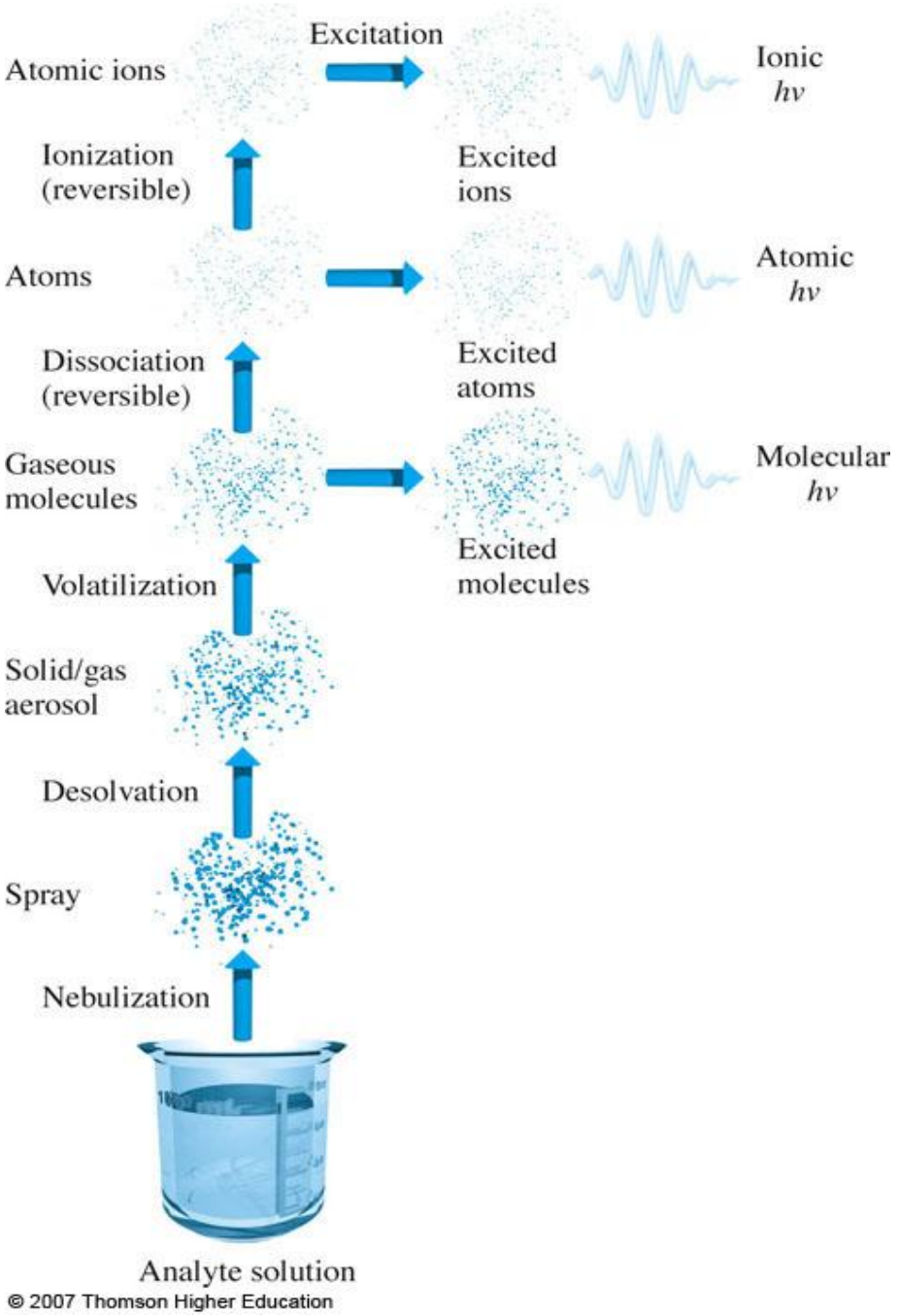
- The two most common methods of sample atomization encountered in AAS and AFS,
  - *Flame atomization and*
  - *Electrothermal atomization,*
- Three specialized atomization procedures
  - *Glow-Discharge Atomization*
  - *Hydride Atomization*
  - *Cold-Vapor Atomization*

used in both types of spectrometry.

9A-1 Flame Atomization:

In a flame atomizer, a solution of the sample is nebulized by a flow of gaseous oxidant, mixed with a gaseous fuel, and carried into a flame where atomization occurs. The following processes then occur in the flame.

- *Desolvation: Solvent evaporates to produce a finely divided solid molecular aerosol.*
- *The aerosol is then volatilized to form gaseous molecules.*
- *Dissociation (leads to an atomic gas)*
- *Ionization (to give cations and electrons)*
- *Excitation (giving atomic, ionic, and molecular emission)*



Types of Flames:

TABLE 9-1 Properties of Flames

Fuel	Oxidant	Temperature, °C	Maximum Burning Velocity, cm s^{-1}
Natural gas	Air	1700–1900	39–43
Natural gas	Oxygen	2700–2800	370–390
Hydrogen	Air	2000–2100	300–440
Hydrogen	Oxygen	2550–2700	900–1400
Acetylene	Air	2100–2400	158–266
Acetylene	Oxygen	3050–3150	1100–2480
Acetylene	Nitrous oxide	2600–2800	285

Several common fuels and oxidants can be employed in flame spectroscopy depending on temperature needed.

- Temperatures of 1700°C to 2400°C are obtained with the various fuels when *air serves as the oxidant*. At these temperatures, only easily decomposed samples are atomized.
- For more refractory samples, *oxygen or nitrous oxide* must be employed as the oxidant. With the common fuels these oxidants produce temperatures of 2500°C to 3100°C.