

ION SOURCES

Several methods are there for converting the sample into the gaseous ionic phase these are as under:



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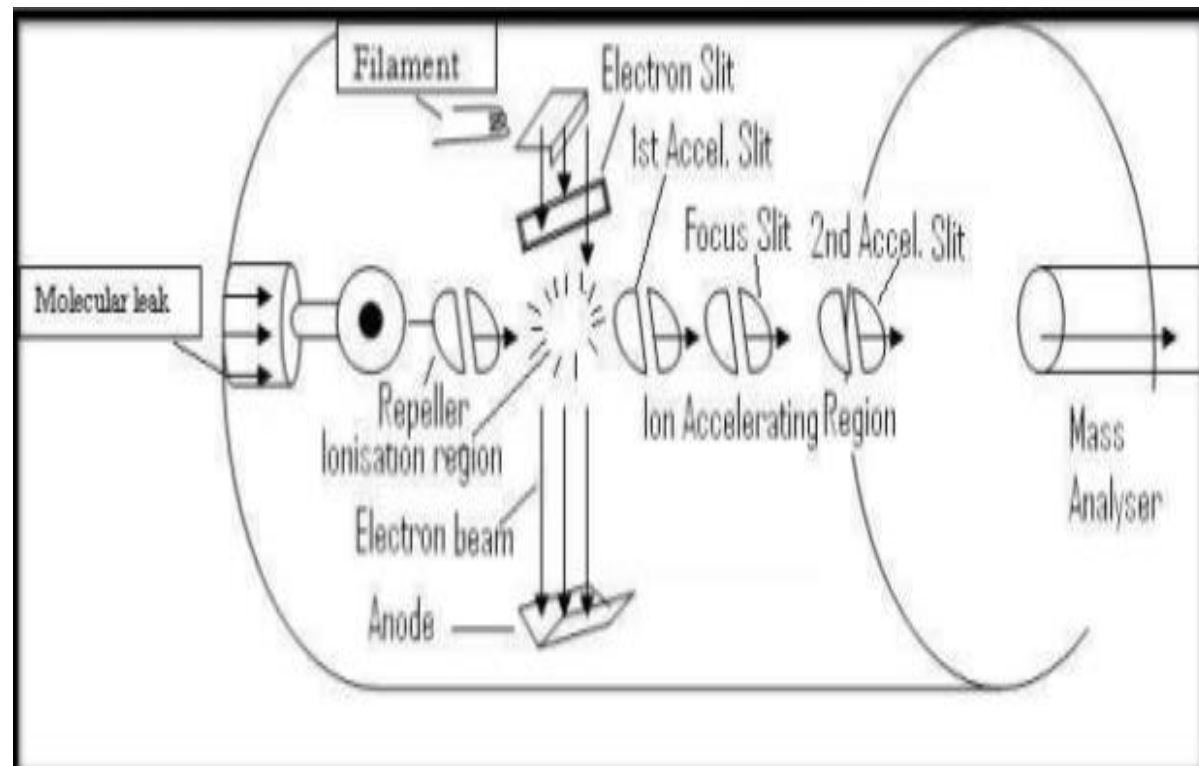
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Electron Impact Ionization (EI)

- It is the type of hard ionization technique due to the high energy of Electron Impact. Ions are accelerated at the voltage of $\sim 10^4$ V.
- Ionization method as name includes the impact of beam of high energetic electron to a gaseous phase or the volatile organic sample.
- Due to the electron impact the sample is broken into positive or negative ions.
- The energetic electron beam is emitted by an electrically heated tungsten or rhenium which are then accelerated by the potential difference of 70eV.

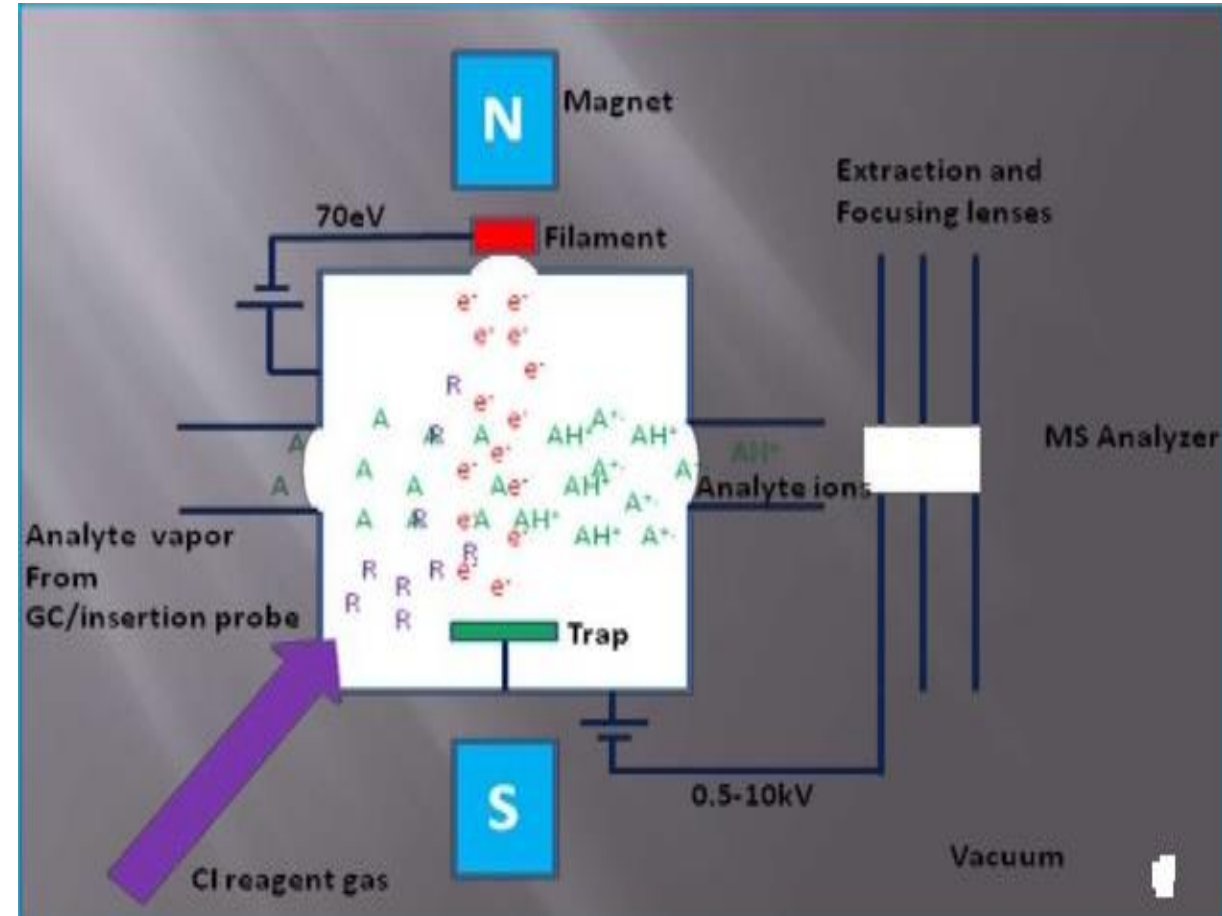


- Collision between ions and molecules may also result in ion with higher m/z values than the molecular ion. Where M^+ is a radical cation which gives molecular weight



Chemical Ionization (CI)

- EI is not appropriate for certain compounds due to the excessive fragmentation. Chemical ionization includes the ionization of reagent gas in high volume approx 1000 times more.
- Typically used reagent gas is methane, ammonia, isobutane.
- Firstly at high pressure the reagent gas is ionized and subsequently this ionized gas molecule collide with sample as gaseous phase and bring about fragmentation.



- It is a soft ionization technique. Generally have less fragmentation and molecular ion is abundant.

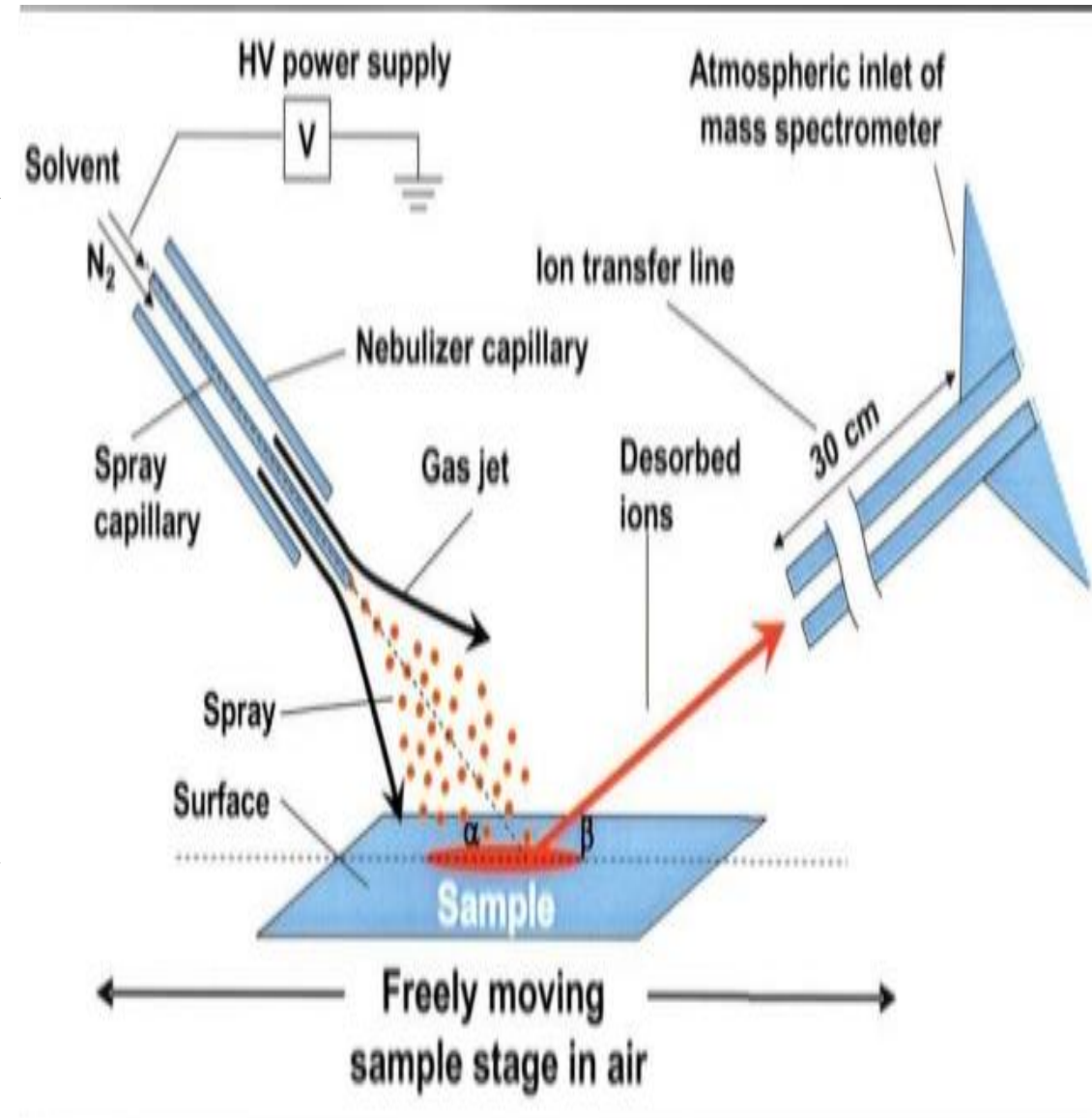
Atmospheric Pressure Ionization(API)

- It operates at the atmospheric pressure. It is used for a mixture of high molecular weight non volatile compound.

- It is of various types which are:
 - a) Matrix Assisted Laser Desorption Ionization (MALDI)
 - b) Electrospray Ionization (ESI)
 - c) Atomic Pressure Chemical Ionization (APCI)
 - d) Atomic Pressure Photon Ionization (APPI)

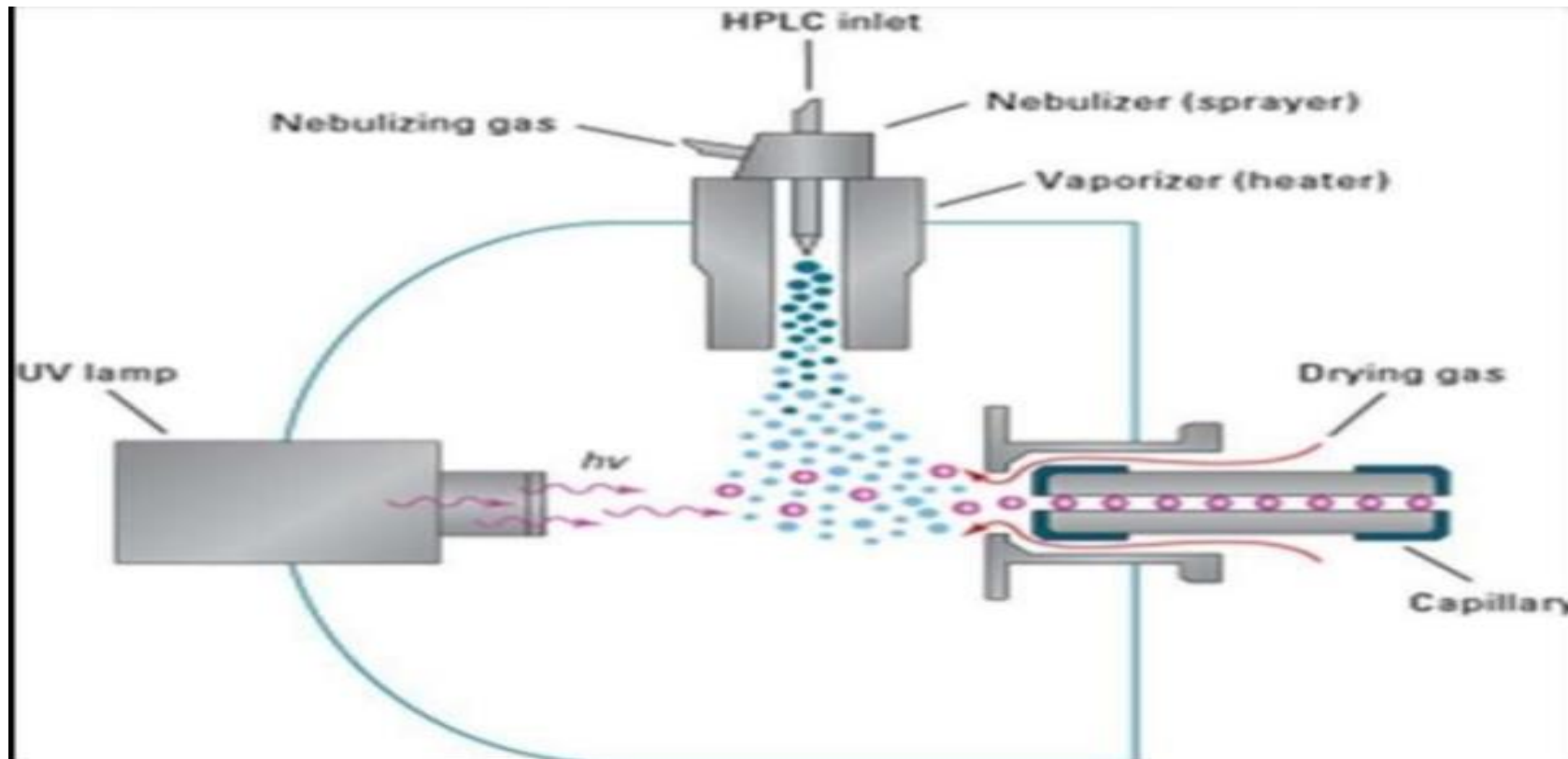
Electron Spray Ionization (ESI)

- It operates at atmospheric pressure. A sample solution is sprayed from a small pore into electric field in the presence of flow of warm nitrogen to assist desolvation.
- The droplets thus formed evaporates in the region of vacuum maintained at high pressure to form ions. The increased pressure causes the charge to increase in the ion thus formed.
- Generally used for molecule such as peptides, proteins, organometallic and polymers but cannot be used for buffer of phosphates as the trace level of this can interfere with ESI process.



Atomic Pressure Photon Ionization (APPI)

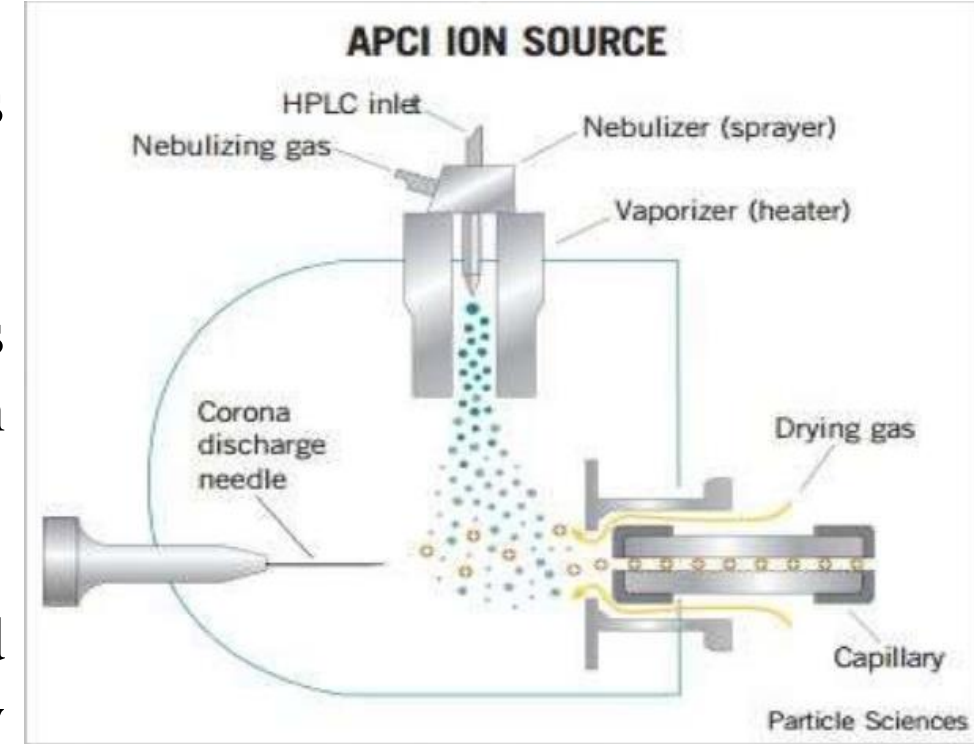
- A mixture of the analyte and the solvent i.e. a liquid solution is first vaporized with the help of nebulizing gas N₂.
- The mixture enters the ionization chamber at atmospheric pressure. The mixture is then exposed to the UV source of krypton lamp.



- The photon emitted from this lamp has a specific energy level i.e. 10eV.
- It is high enough to ionize sample excluding the unwanted species. Hence analyte molecule is analyzed or measured.

Atomic Pressure Chemical Ionization (APCI)

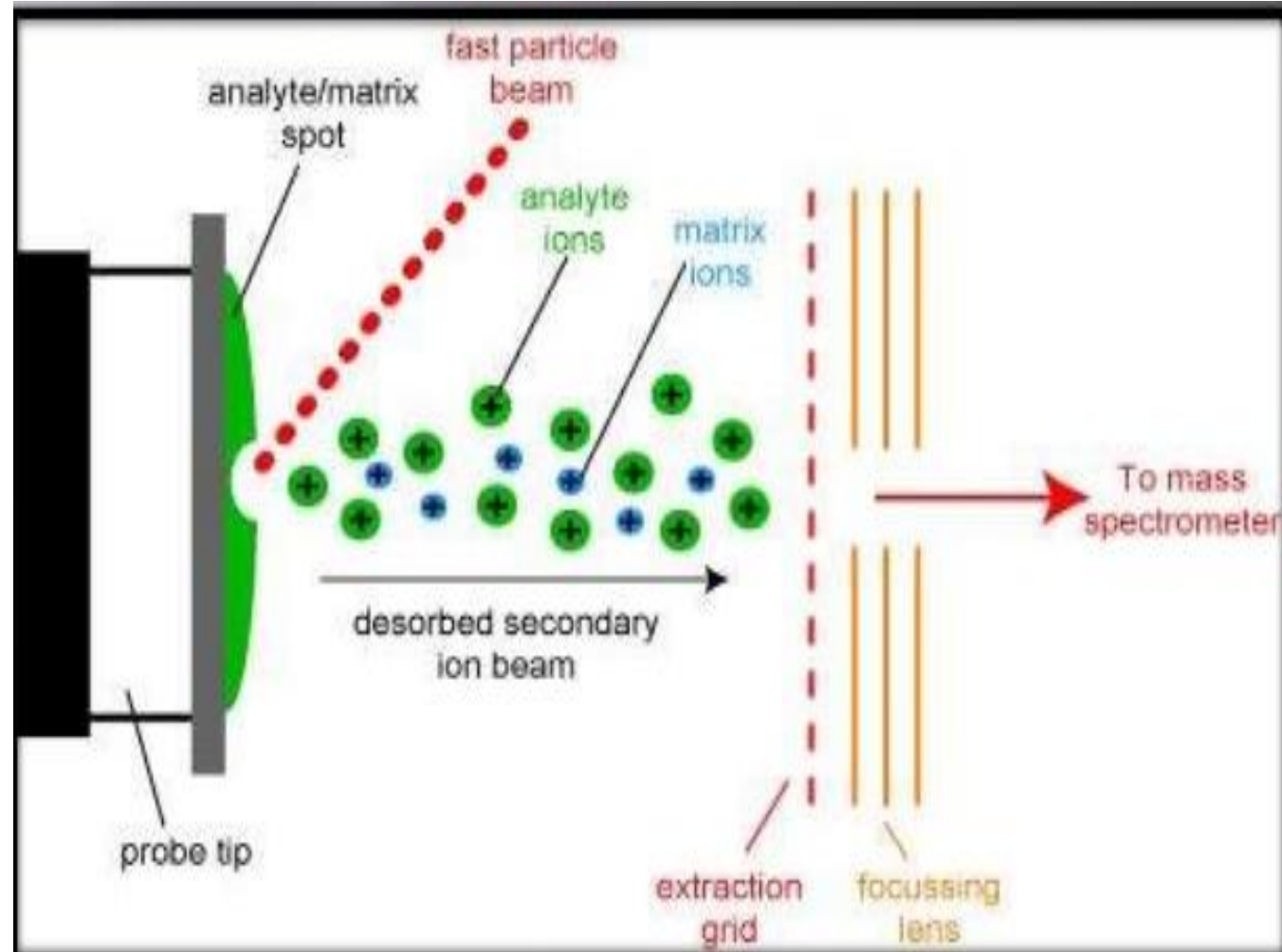
- The corona discharge produces primary ions in this technique.
- The nebulized sample via high speed nitrogen gas is displaced to a quartz tubing called as desolvation chamber.
- In desolvation chamber these droplets are converted to mixture of compound which are subsequently carried to a corona discharge electrode.
- Due to these molecule are thus ionized in two ways or modes : Positive mode: proton transfer or charge exchange occurs . Negative mode: proton abstraction or electron capture or adduct formation is their.



□ It produces singly charged species. Generally employed for large biomolecules and polymers. It is a high mass pulsed technique hence it is generally combined with TIME OF FLIGHT

FAST ATOM BOMBARDMENT (FAB)

- ❑ For polar molecules such as peptides with molecular weight up to 10000 can be analyzed by soft ionization technique called as Fast Atom Bombardment.
- ❑ Thermally unstable molecule it works well as it works at room temperature. The beam for bombardment is generally consist of Xenon or Argon gas atom of high energy, the beam is produced by ionizing xenon atom by the electrons.
- ❑ The sample is dissolved in glycerol and fine layer is formed over metal probe which is then ionized by fast beam of xenon or argon striking the sample.



- ❑ Generally it causes less fragmentation and molecular ion is obtained. Hence sample mass is analyzed in this way