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Chem 322 M.S. Problems

- 9.3 Hard ionization sources tend to lead to more fragmentation of parent ions, while soft ionization sources produce less fragmentation.
- 9.4 Description of EI source on p. 622. Briefly - influence of e^- beam produced at filament leads to ionization. Ions are accelerated out of the source using ion optics. This is a hard ionization source. Therefore, EI sources are good for structural information, but less well suited for molar mass determination.
- 9.5 Description of CI source on p. 624. Formation of reagent gas ions produces less fragmentation of analyte, since collisions are less energetic. So, CI is a soft source. CI sources are more well suited for molar mass determination, compared to EI.
- 9.9. You could describe Electrospray (ESI) + Atmospheric Pressure Ionization (API). See p. 625 for descriptions.
- 9.10 Your diagram should resemble fig. 9.22. Advantages are simpler operation, ability to operate at higher pressure + lower cost. Primary disadvantage is poorer resolving power.

9.11 a) Resolution = $\frac{\Delta m}{m} = \frac{84.0085 - 84.0073}{84.0073} \cdot 10^6 = 14.3 \text{ ppm}$

b) $\text{ArCl}^+ = 75.401$, $\text{As}^+ = 74.9216$
 $\frac{\Delta m}{m} = \frac{75.401 - 74.9216}{75.401} \cdot 10^6 = 6358 \text{ ppm}$

c) $\Delta m = \frac{86.0731 - 86.0367}{86.0367} = 423 \text{ ppm}$

9.12 The EI spectrum should have only a very small (if any) peak at $m/z = 269$. Since EI is a hard ionization source, fragment peaks should dominate the spectrum. Since CI is a softer source, a significant molecular ion peak should be observed, likely @ $m/z = 270$ due to proton transfer from methane reagent gas.

9.13 Your diagram should resemble figure 9.10, MALDI makes it possible to get large molecules into the gas phase as primarily intact molecular ions.

9.14 Your diagram should resemble figure 9.20 + 9.19. The description begins on p 635. The reflection helps to focus ions of varying KE, but the same mass. This increase in focus improves resolving power.

9.15 MS-MS experiments allow selection of a particular ion, subsequent reaction with that ion + analysis of the products of that reaction. One can glean more structural information from an MS^n experiment.

9.20 Faraday cup detectors are simpler in design & operation than EM detectors, but are much less sensitive. FC detectors do not exhibit mass discrimination, as do EM.

9.22 See descriptions beginning on p 642.

Chapter 10

10.31 See figure 10.35. The sampler & skimmer cones serve to prevent a large fraction of the gas at the plasma tip from entering the MS.

10.33 GC is easier because the difference in pressure is less & because the sample is already in the gas phase.

10.34 Quadrupoles are typically used. Ion traps are used as well.

10.36 See Section 10.4.3. You should discuss Matrix effects & Isobaric interferences.

10.37 The addition of a collision or reaction cell following the introduction of ions serves as a location where polyatomics can be broken apart. Products of these collisions have an unstable path through the cell & are filtered out.