

## 7: END OF CHAPTER QUESTIONS-

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1. You work for a mass spectrometer vendor who sells all the instruments described here. Make a product table that shows all the different options for each major part of the mass spectrometer.
  2. Using thermochemical data, find the energy required to remove an electron from the following species:  $\text{H}_2$ , Na, C,  $\text{CH}_4$ , and Fe. Express this energy in kJ/mole and eV (per atom).
  3. Using thermochemical data, determine the energy required to break the following bonds:  $\text{H}-\text{H}$ ,  $\text{C}-\text{C}$ ,  $\text{C}=\text{C}$ ,  $\text{C}-\text{H}$ , and  $\text{C}-\text{O}$ . Express this energy in kJ/mole and eV (per atom).
  4. Determine the kinetic energy, velocity, and momentum of the following ions:  $m/z$  10, 50, 100, and 1000. The ions are formed in the center of the source region, which is 10.0 mm long and has a 5000 V potential applied across the two ends.
  5. How long would it take each of the ions from question 4 to travel through a 1 meter flight tube in a TOF mass spectrometer?
  6. What magnetic field is required to select each of the ions from question 4 in a magnetic sector with a radius of 1 meter?
  7. What is the cyclotron frequency of each ion from question 4 in an ICR with a 3 T magnetic field?
  8. What electric field strength is required for each of the ions from question 4 to be selected by an electric sector with a radius of 0.5 meter?
  9. What is the  $m/z$  value for the molecular ion produced by EI of the following molecules: A) benzene, B) octane, C) trinitrotoluene, D) acetone, E) t-butyl amine.
  10. The highest mass ion observed in a mass spectrum is at  $m/z$  127. If the compound contains a single N atom, could this be the molecular ion? If the compound contains four N atoms, could this be the molecular ion? Why?
  11. The molecular ion in a high resolution mass spectrometry experiment is observed at  $m/z$  58.0055. What is the molecular formula for this compound? If this was a low resolution mass spectrometer, what other molecular formula's are possible?
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