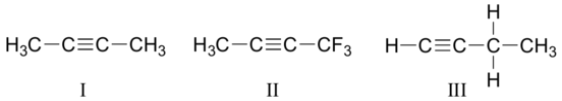
4.P: Problems for Chapter 4

link to Solution Manual

P4.1: Which represents a higher energy frequency of electromagnetic radiation, 1690 cm^{-1} or 3400 cm^{-1}? Express each of these in terms of wavelength (meters) and frequency (Hz).

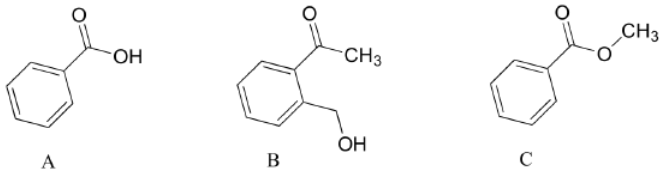
P4.2: Calculate the value, in kcal/mol, of the energy gap associated with a typical ketone carbonyl stretching transition at 1720 cm^{-1}.

P4.3: Explain how you could use IR spectroscopy to distinguish between compounds I, II, and III.



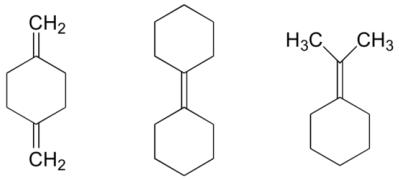
I II III

P4.4: Explain how you could use IR spectroscopy to distinguish between compounds A, B, and C.



A B C

P4.5: Explain how you could use IR spectroscopy to distinguish between compounds X, Y, and Z.

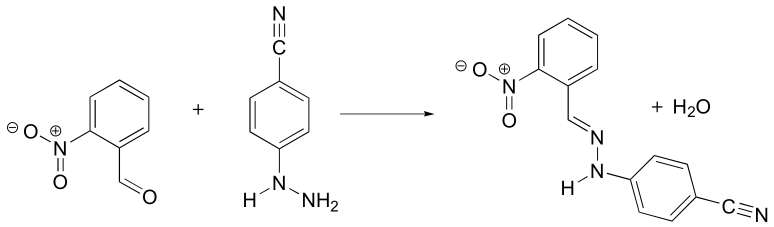


X Y Z

P4.6: A 0.725 mL aqueous solution of NADH shows an absorbance at 340 nm of 0.257. Express (in nanamole (nm) units) how much NADH is contained in the sample.

P4.7: A 1 mL enzymatic reaction mixture contains NADH as one of the reactants, and has a starting A_{340} = 0.345. After the reaction is allowed to run for five minutes, the researcher records a value of A_{340} = 0.125. How many nm of NADH are used up per minute, on average, in this reaction?

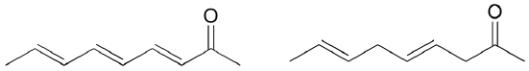
P4.8: The reaction below is of a type that we will study in Chapter 11. While the two starting materials are only slightly colored, the product is an intense orange-red. Account for this observation.



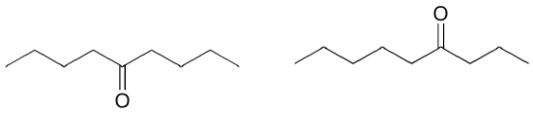
P4.9: Predict five fragments that you would expect to be evident in the mass spectrum of 3-methyl-2-pentanone.

P4.10: One would expect the mass spectrum of cyclohexanone to show a molecular ion peak at m/z = 98. However, the m/z = 98 peak in the cyclohexanone spectrum is unusually tall, compared to the molecular ion peaks in the mass spectra of other ketones such as 2-hexanone or 3-hexanone. Explain.

P4.11: Which would be more useful in distinguishing the two compounds shown below: IR or UV spectroscopy? Explain.



P4.12: Which analytical technique – IR, UV, or MS - could best be used to distinguish between the two compounds below? Explain.



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