

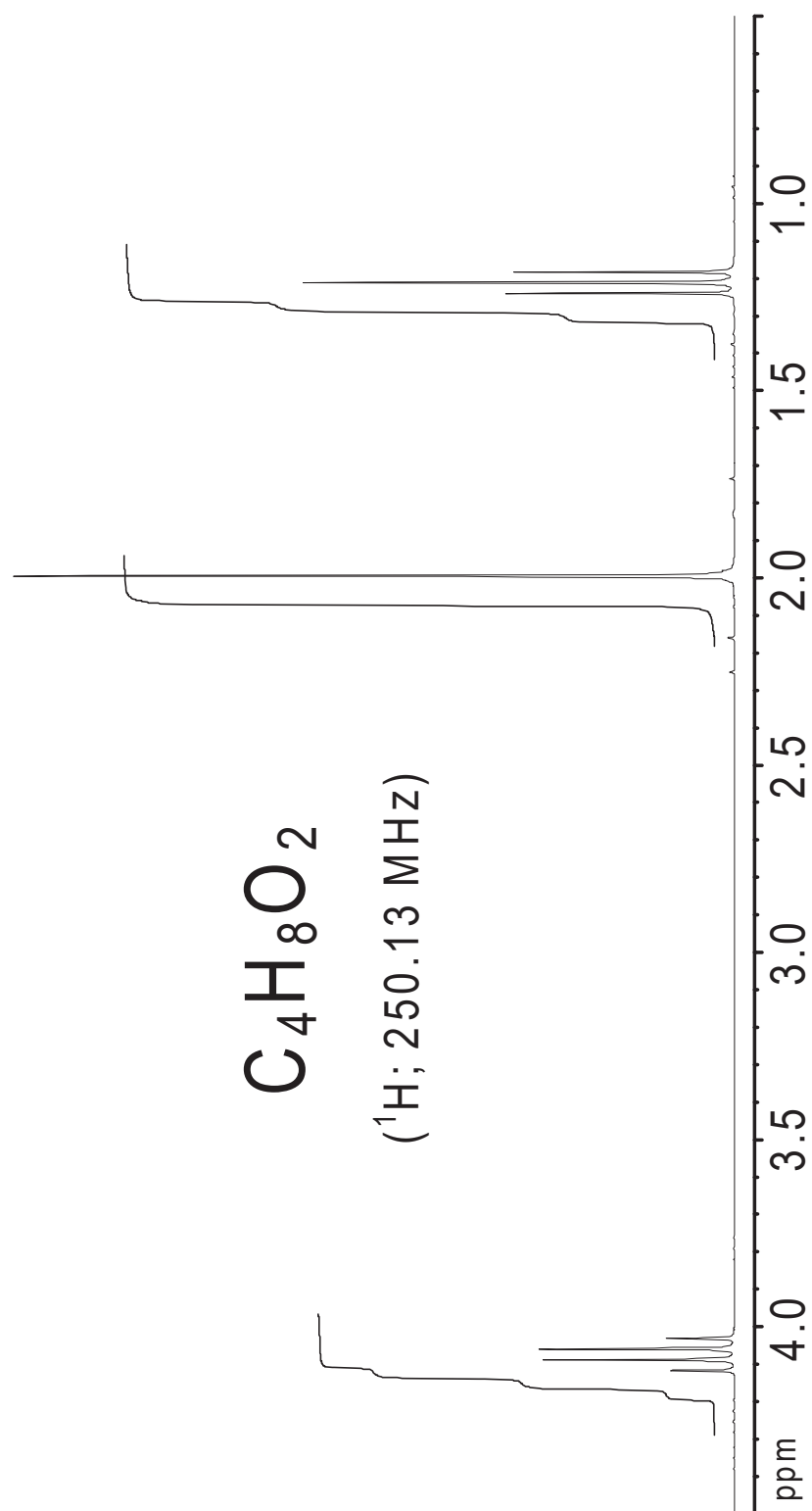
**Problem 1**

Translated from Art van der Est)

Using the chemical shift rules for CH-, CH<sub>2</sub>- und CH<sub>3</sub>-Groups draw the stick spectrum for propionic acid chloride. There is no shift rule for acid chloride groups. Search for an acceptable alternative.

**Problem 2**

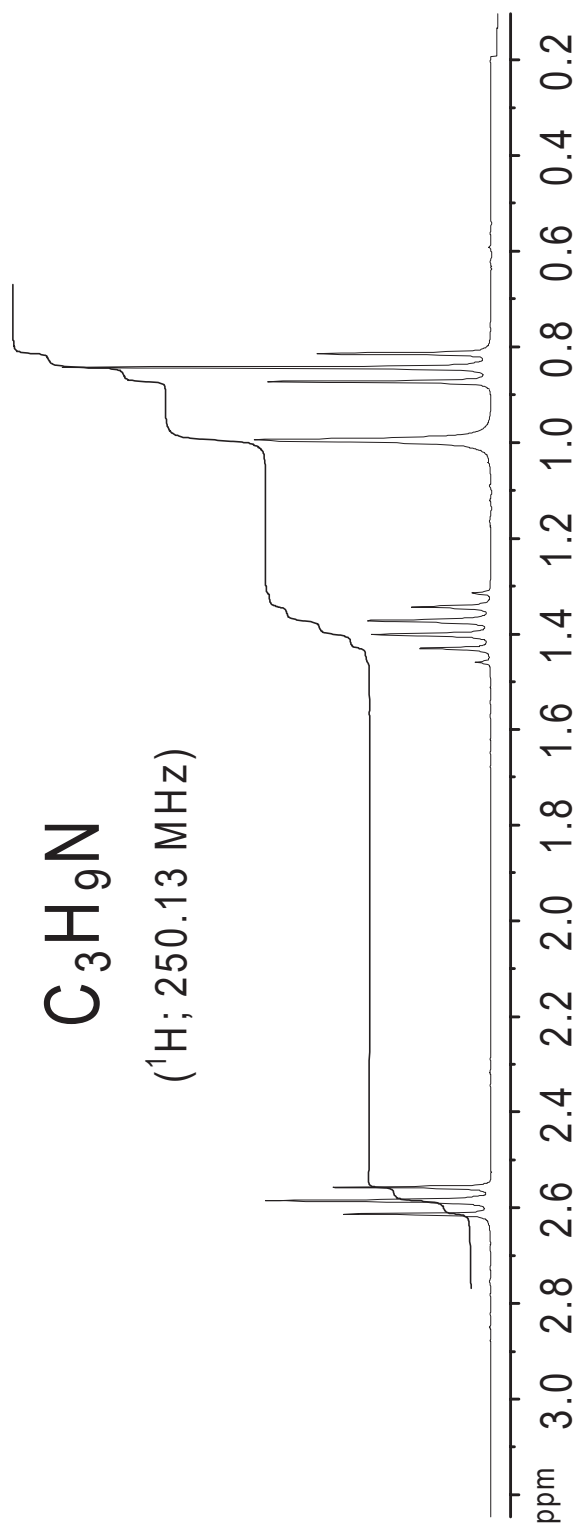
(Translated from Art van der Est)



**Exercises, problem 2:** Determine the structure. Note that the integrals have been shifted a few millimeters to the left for clarity.

**Problem 3**

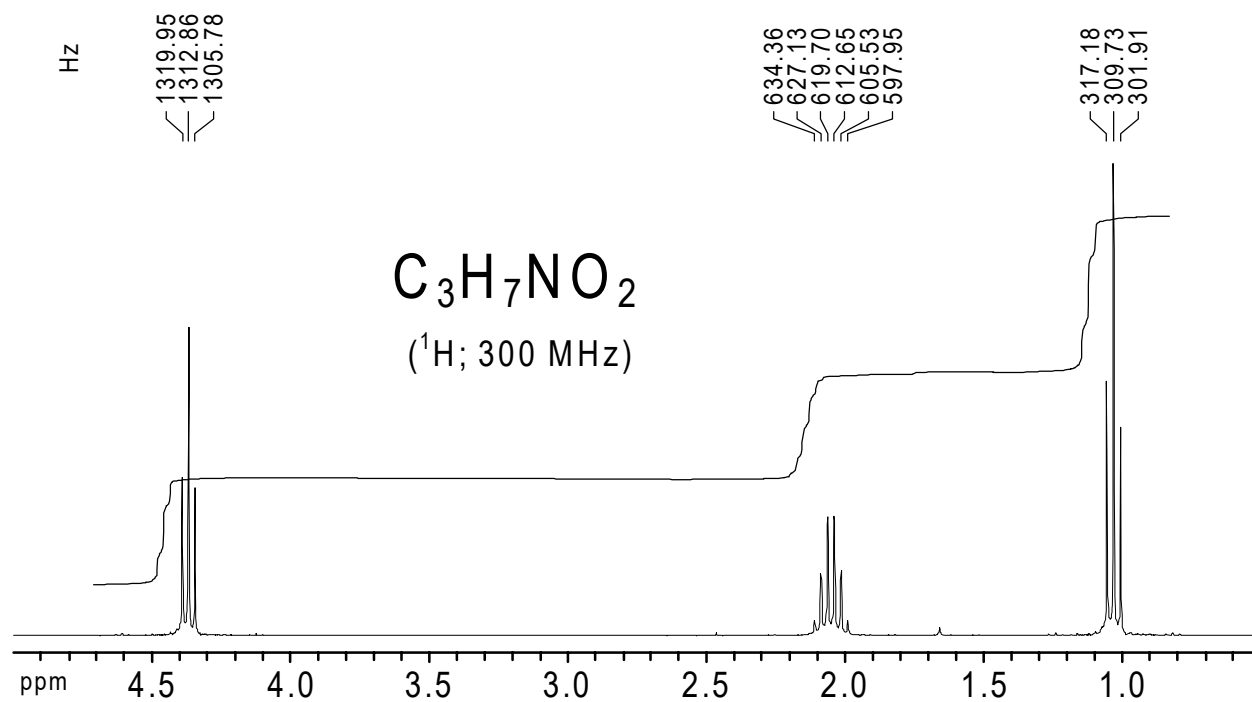
(Translated from Art van der Est)



**Exercises, problem 3:** Determine the structure! Explain the splitting patterns! How large do the coupling constants have to be? Estimate the chemical shifts using the appropriate shift rules!

**Problem 4**

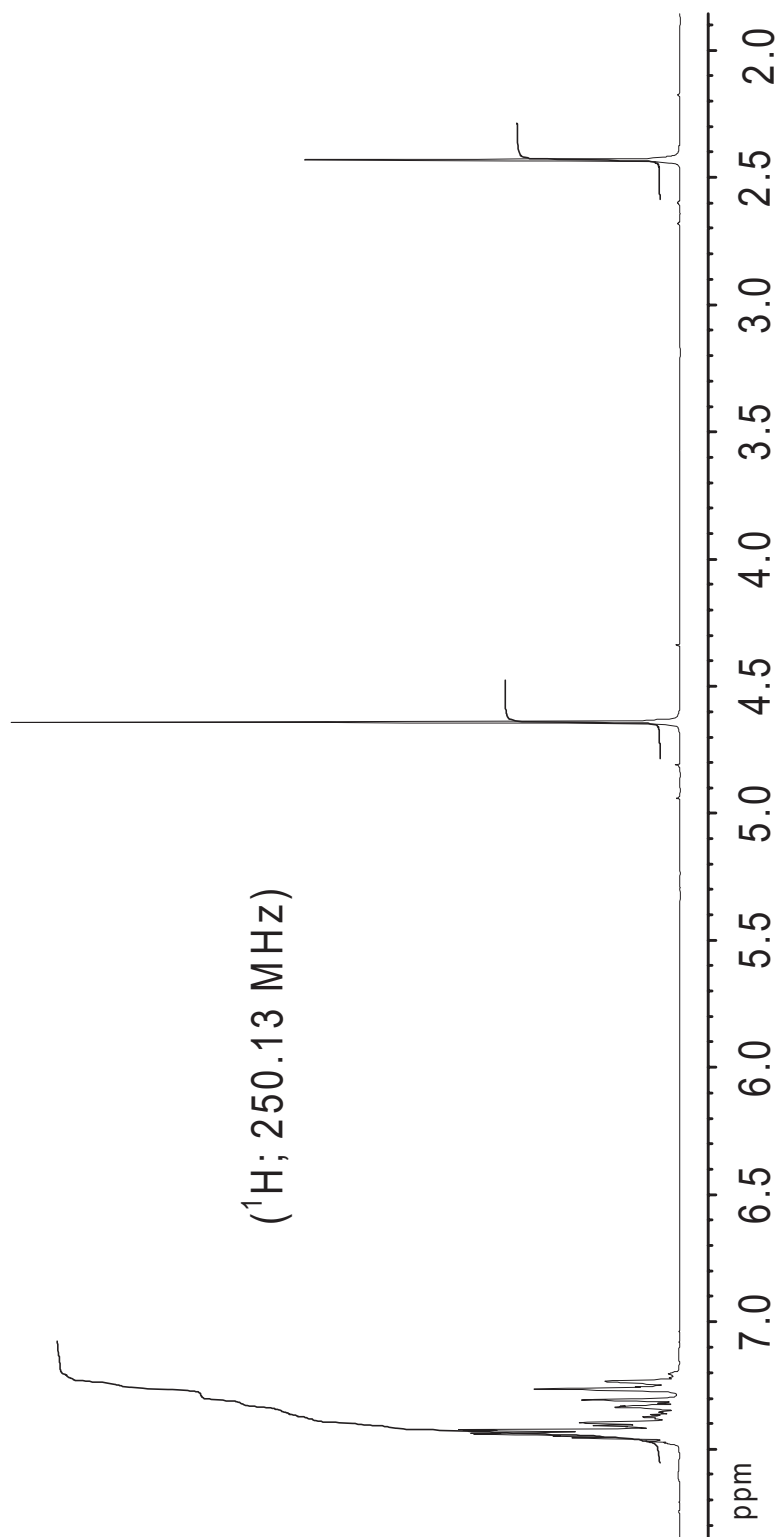
(Translated from Art van der Est)



**Exercises, problem 4:** Determine the structure. Why is a clean sextet observed at 2 ppm? What is the actual multiplicity? The data are from a collection of the Pacific Lutheran University, Washington.

**Problem 5**

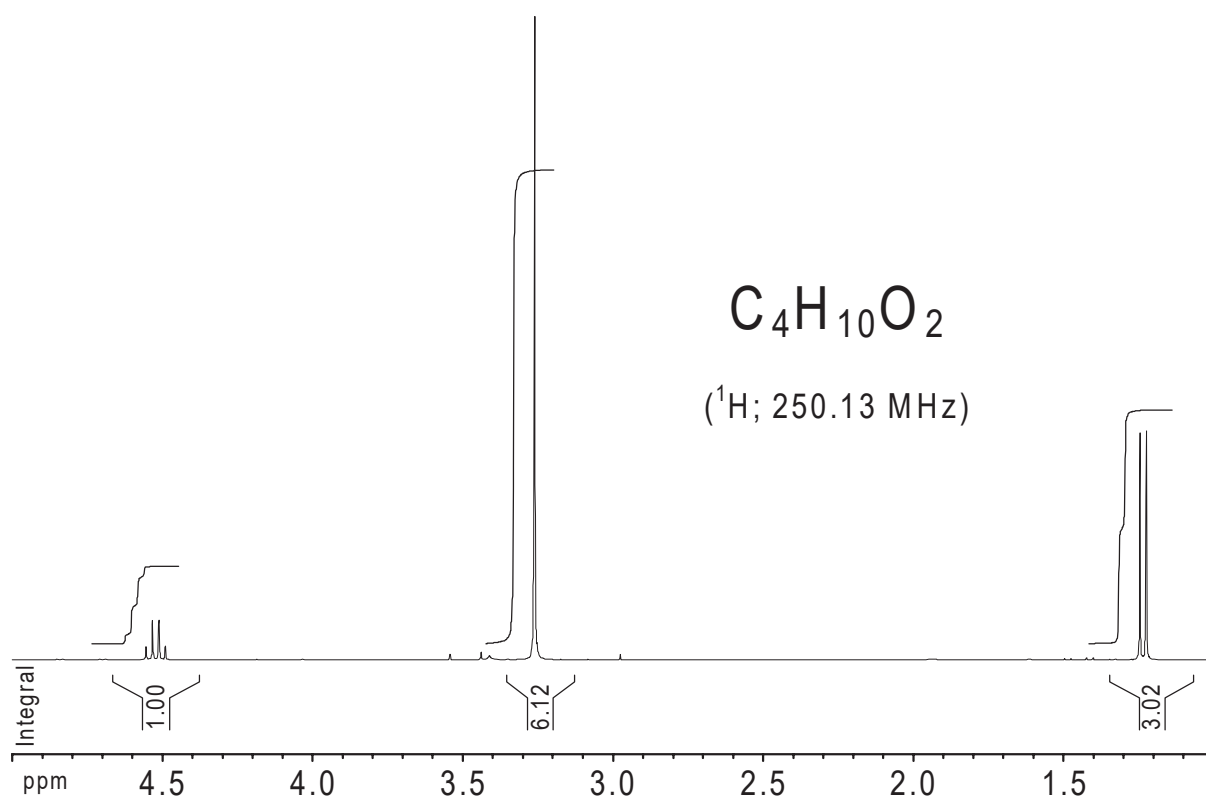
Translated from Art van der Est)



**Exercises, problem 5:** During the photo-chlorination of toluene, a mixture of products is obtained. Using the proton spectrum, determine the two components! In what mole ratio are they present?

**Problem 6**

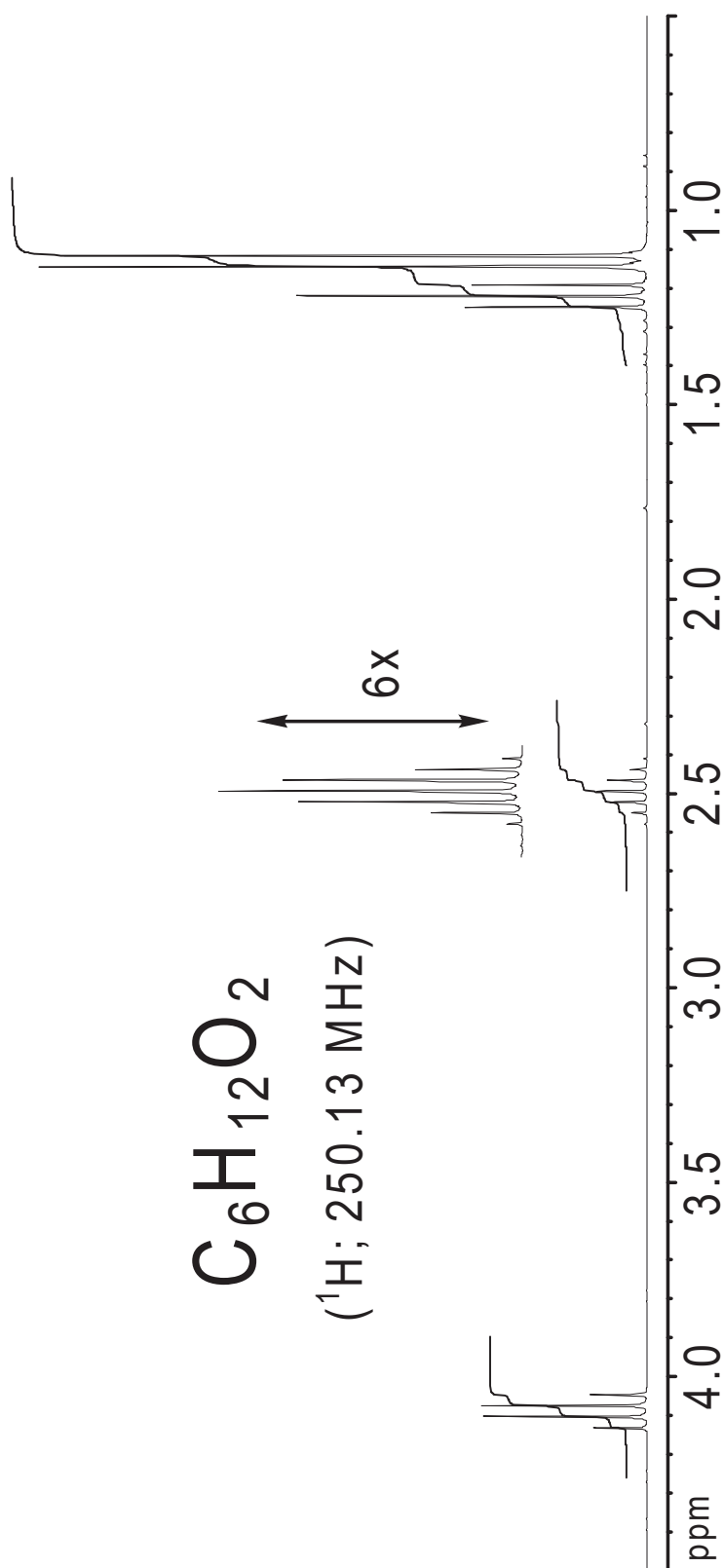
(Translated from Art van der Est)



**Exercises, problem 6:** Determine the structure. Note that the integrals have been shifted a few millimeteres to the left for clarity.

**Problem 7**

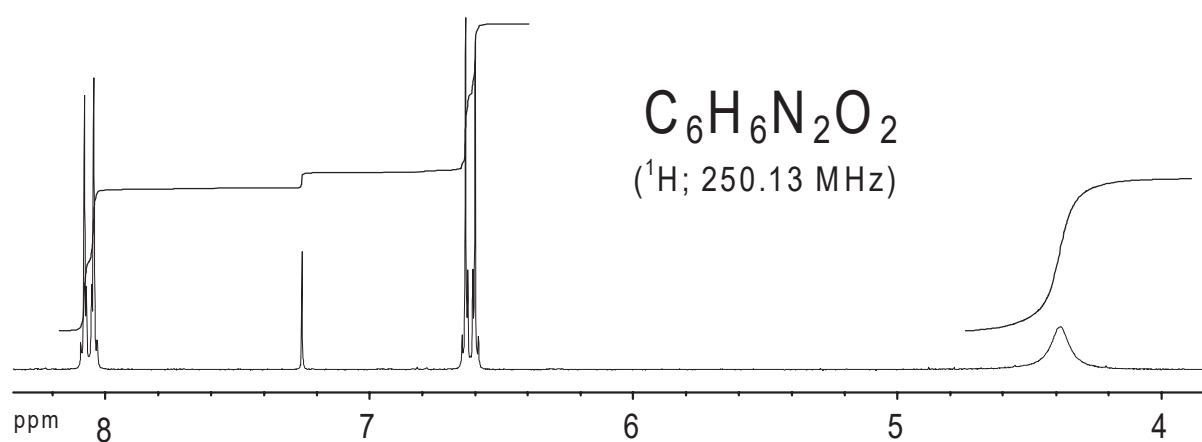
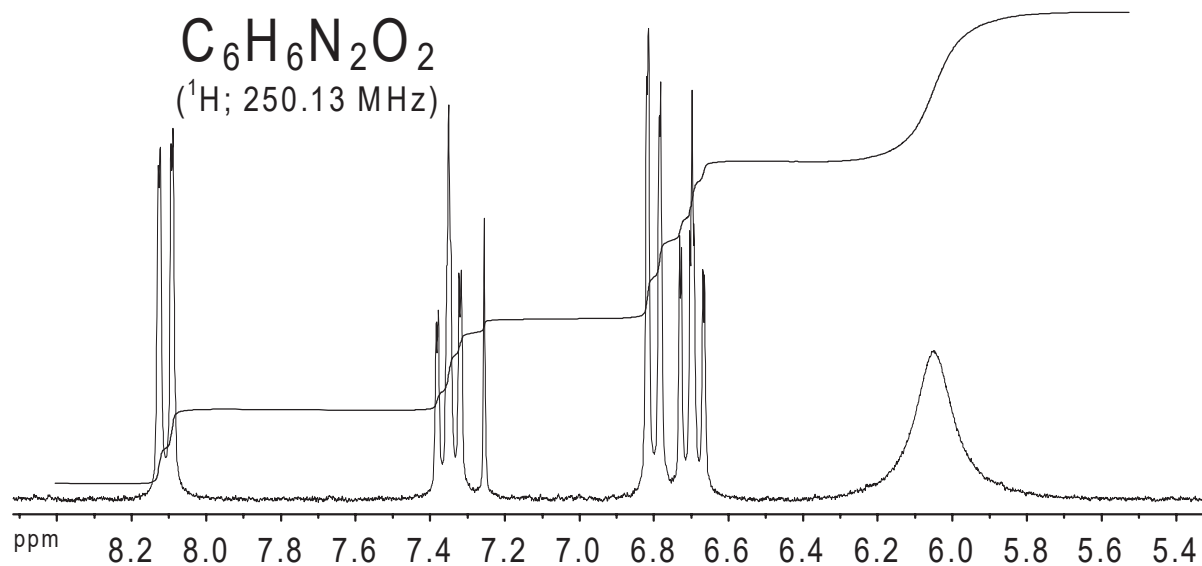
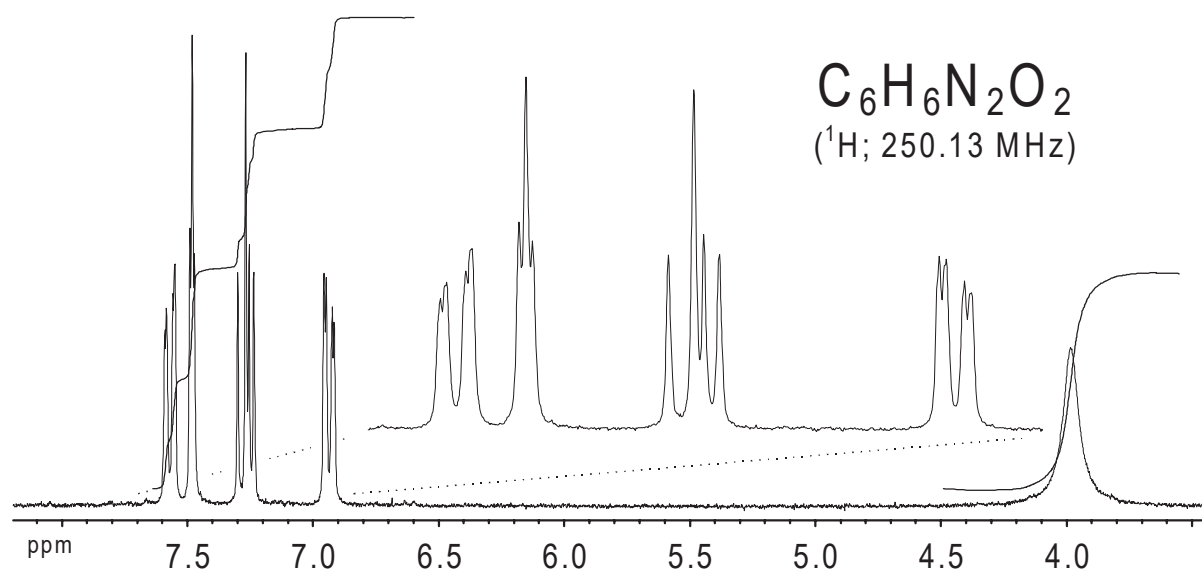
(Translated from Art van der Est)



**Exercises, problem 7:** Determine the structure. Check the chemical shifts using shift rules!

**Problem 8**

(Translated from Art van der Est)

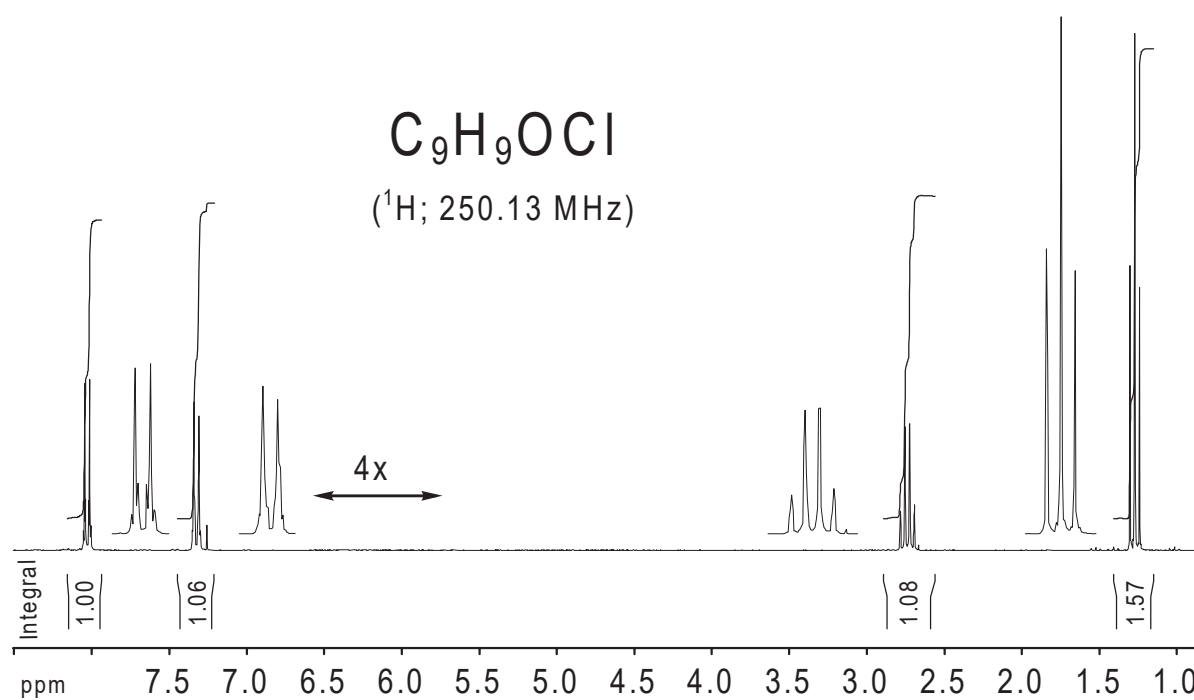


**Exercises, problem 8:** Distinguish the three isomers of a disubstituted benzene derivative! Also interpret the chemical shift of the broad signal! Which solvent was used?



**Problem 9**

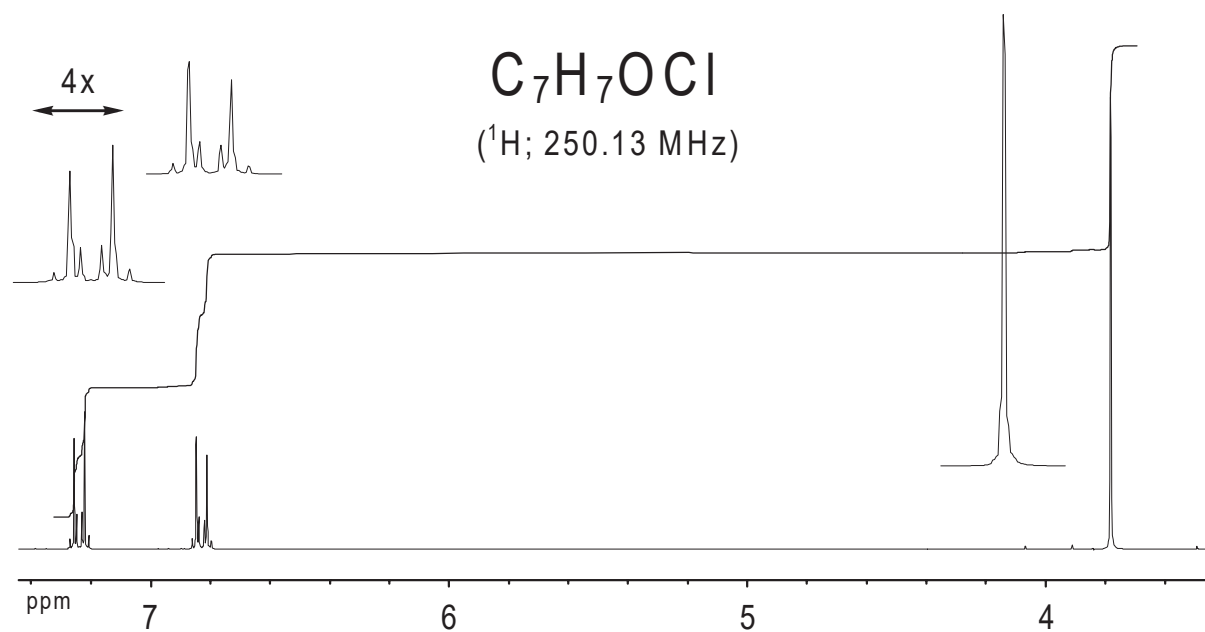
(Translated from Art van der Est)



**Exercises, problem 9:** Determine the structural formula using the NMR-spectrum and the molecular formula!

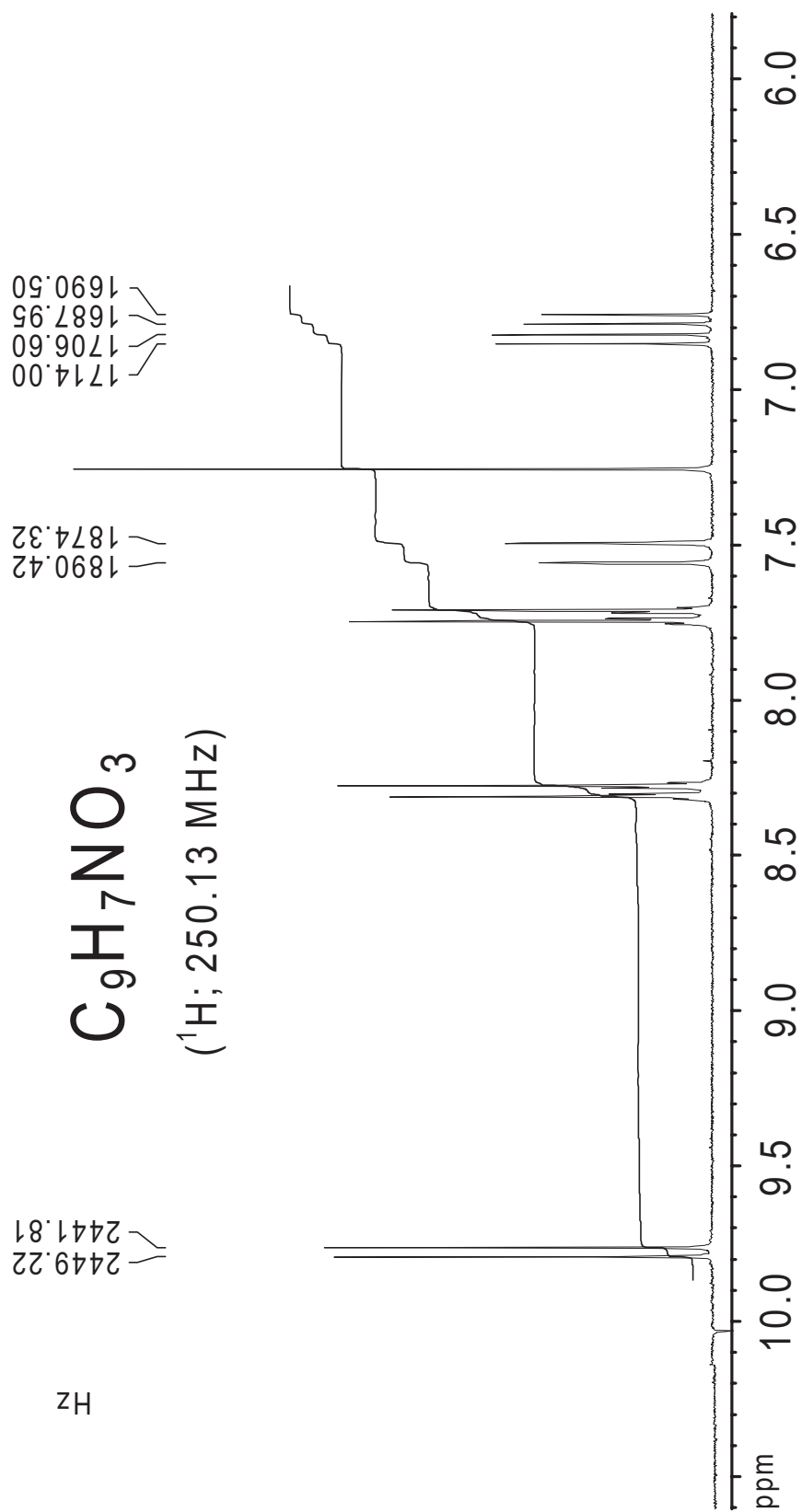
**Problem 10**

(Translated from Art van der Est)

**Exercises, problem 10:** Determine the structure!

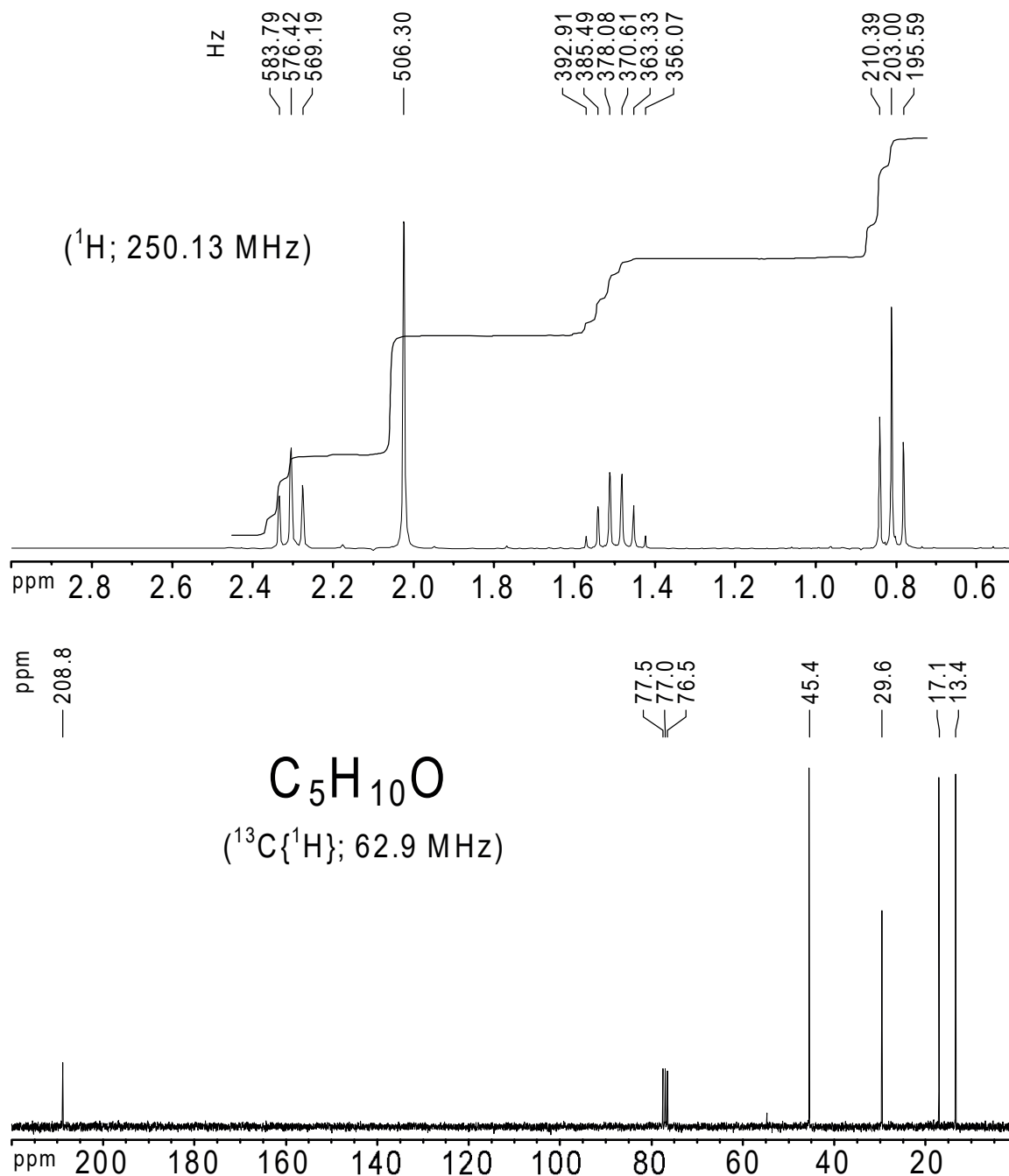
**Problem 11**

(Translated from Art van der Est)

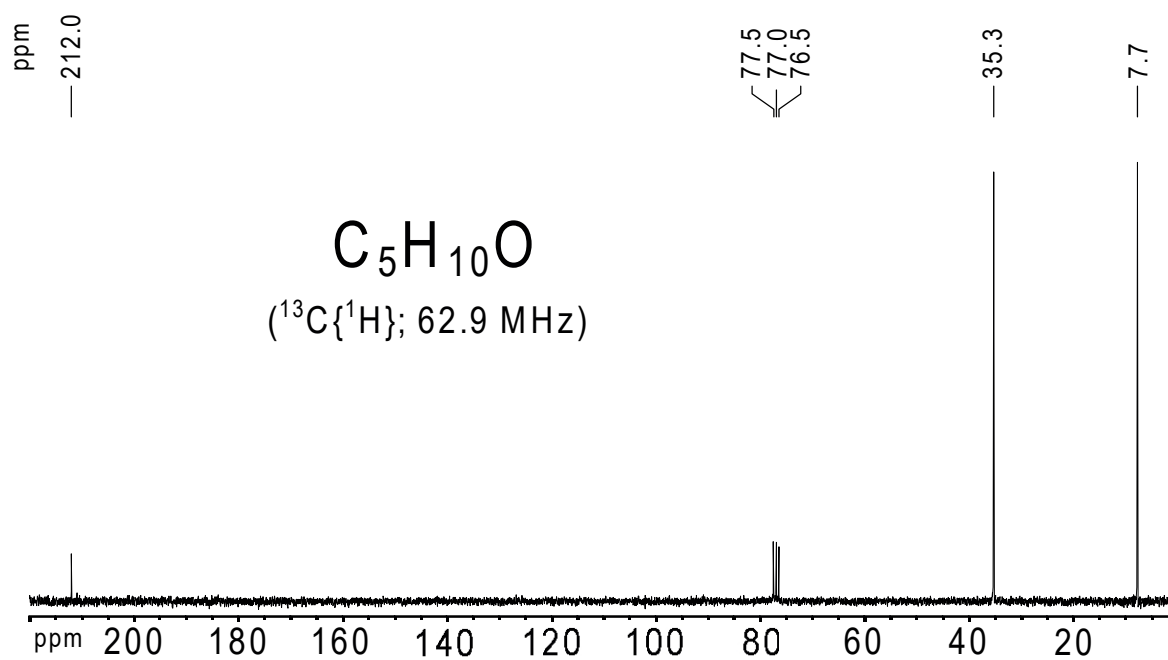
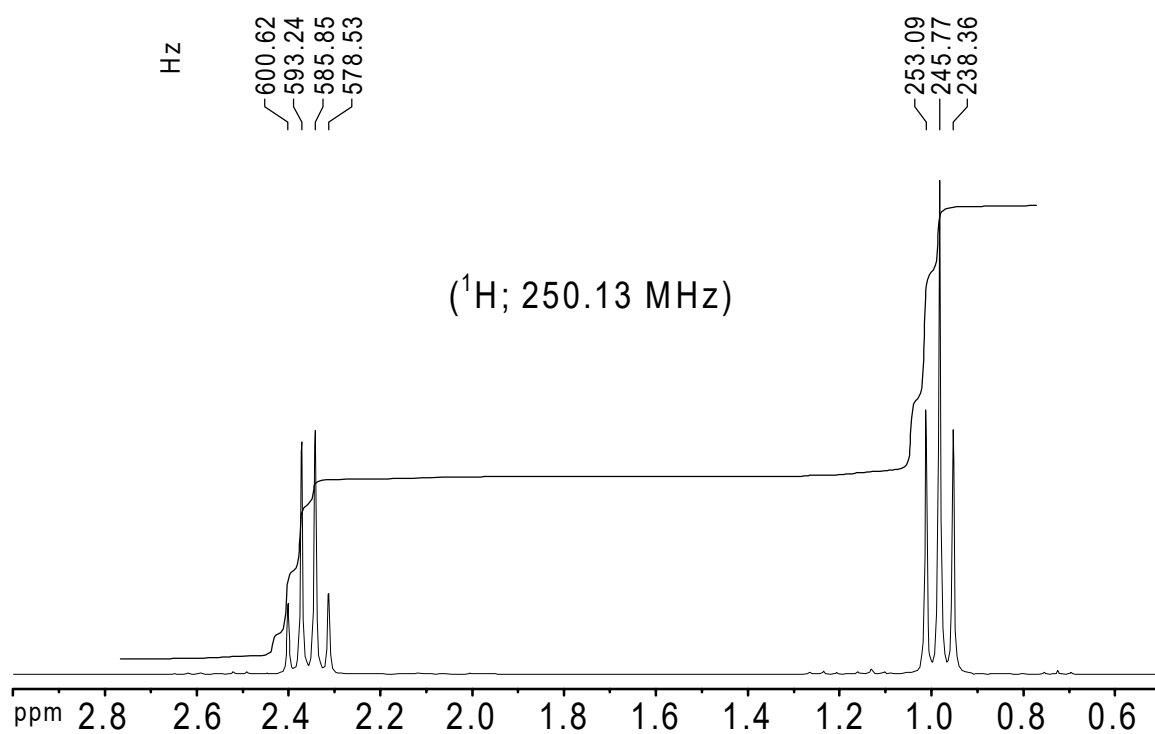
**Exercises, problem 11:** Determine the structure and the conformation!

## Problem 12

(Translated from Art van der Est)



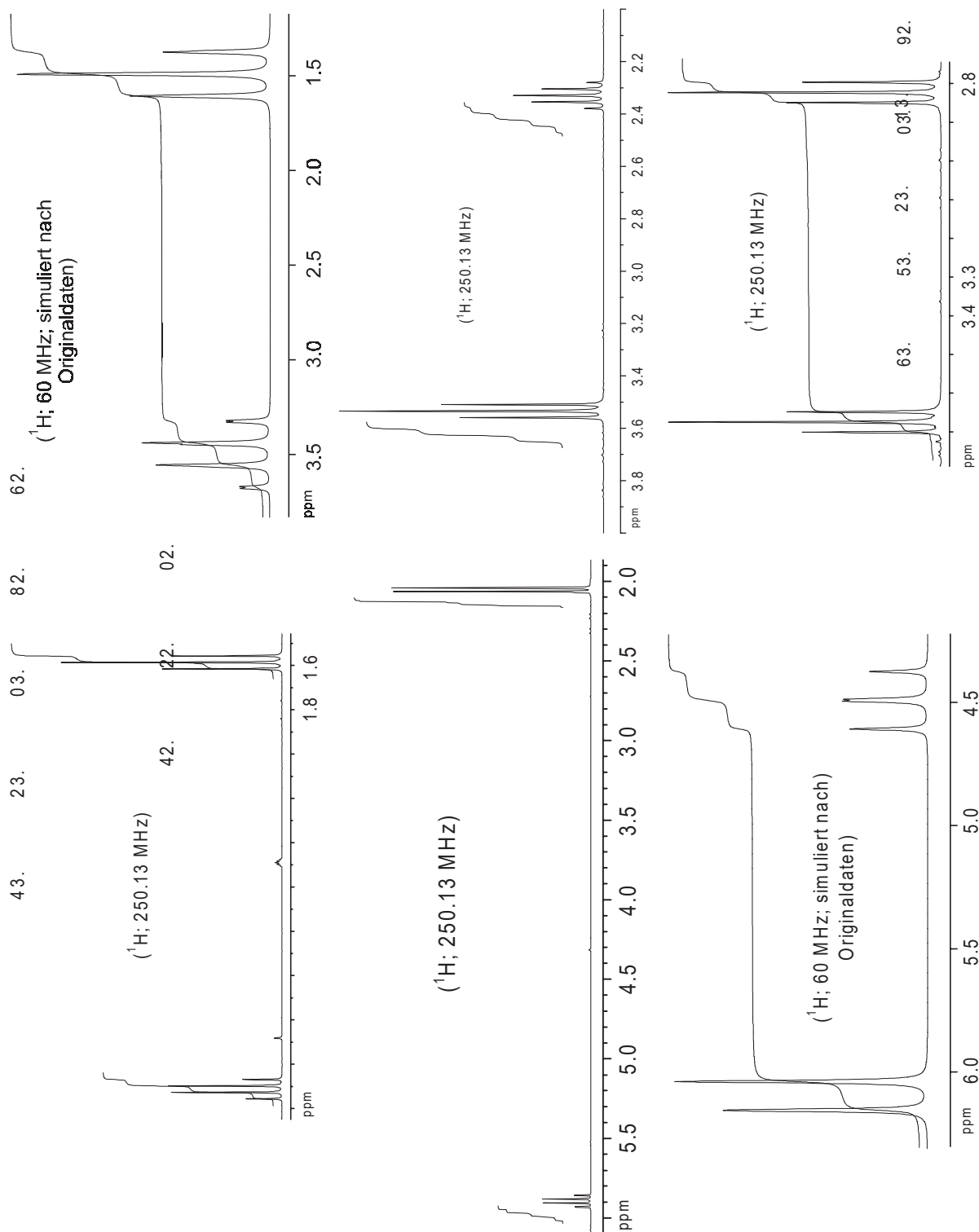
**Exercises, problem 12 (page 1):** Determine the structure of the two structural isomers (see additional spectra on second page)!



**Exercises, problem 12 (page 2):** Assign all of the signals in the spectra on this page!

## Problem 13

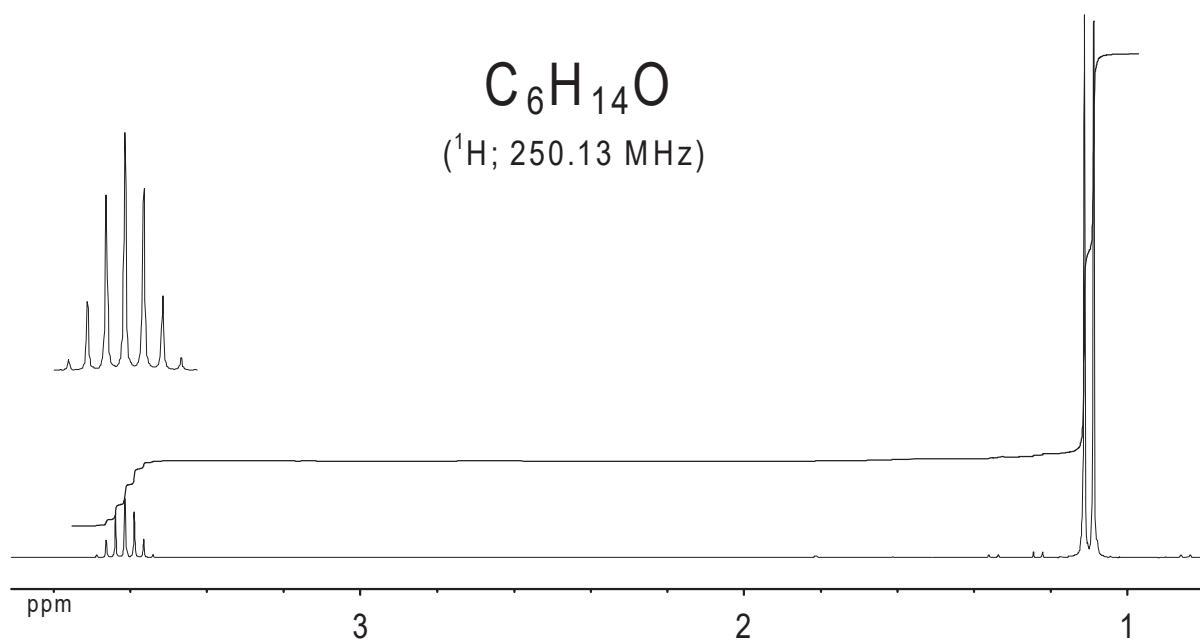
(Translated from Art van der Est)



**Exercises, problem 13:** The 6 spectra correlate with the following structural formulae:  $\text{CH}_3\text{-CH}_2\text{-OH}$ ,  $\text{Cl}_2\text{CH-CH}_2\text{-CHCl}_2$ ,  $(\text{CH}_3)_2\text{-CH-CN}$ ,  $\text{CHCl}_2\text{-CHCl-CHCl}_2$ ,  $\text{CHCl}_2\text{-CHO}$ ,  $\text{N}\equiv\text{C-CH}_2\text{-CH}_2\text{-Cl}$ ,  $\text{CHCl}_2\text{-CHCl}_2$ ,  $\text{CH}_3\text{-CH}_2\text{-Cl}$ ,  $\text{CH}_2\text{Br-CH}_2\text{-CH}_2\text{Br}$ ,  $\text{CH}_3\text{-CH}_2\text{Br}$ ,  $\text{CH}_3\text{-CHCl}_2$  and  $(\text{CH}_3)_2\text{-CHCl}$ . Assign them correctly and explain your choice!

**Problem 14**

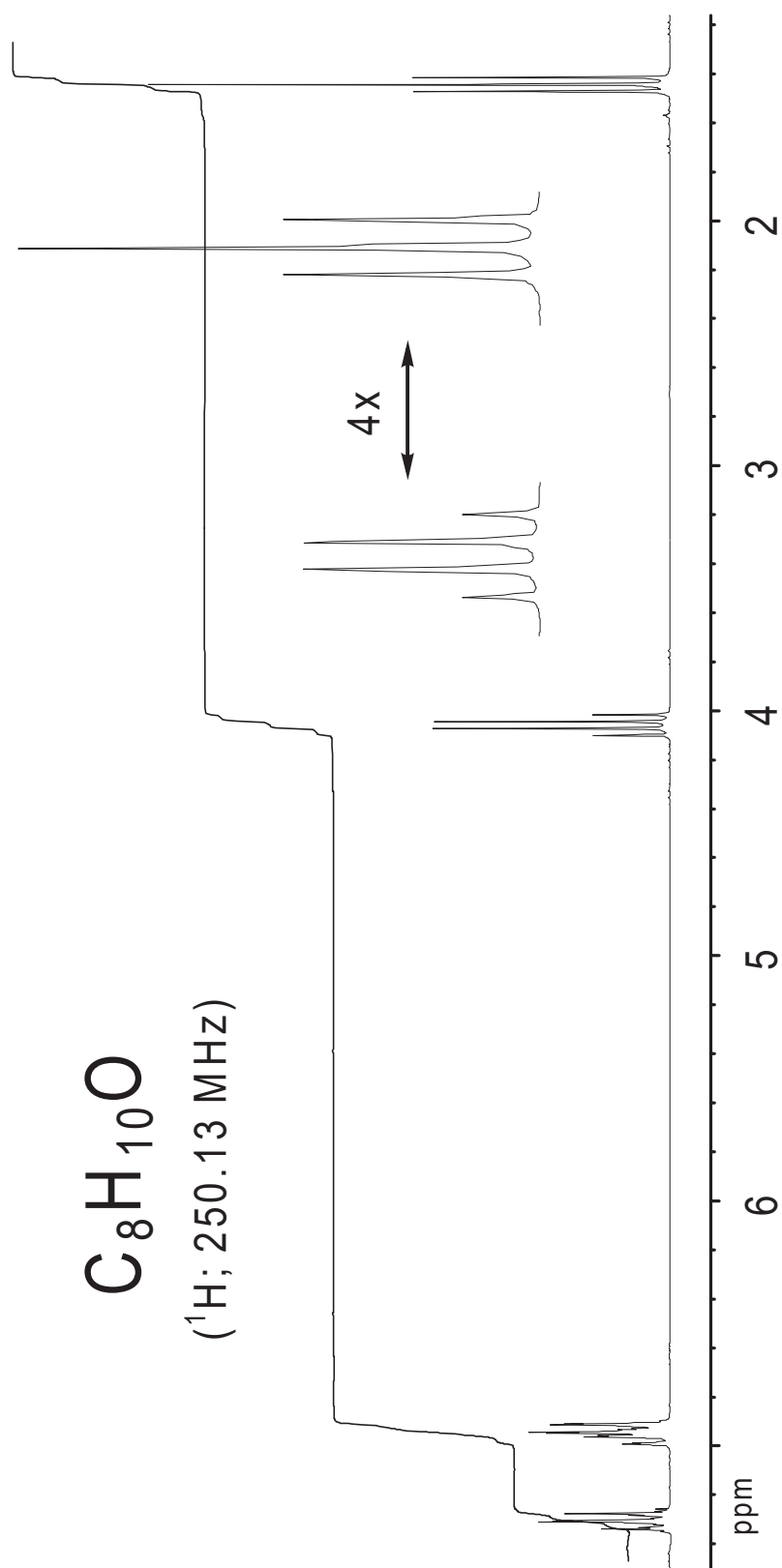
(Translated from Art van der Est)



**Exercises, problem 14:** Determine the structure. Hint: Work out the multiplicity of the multiplets at about 3.6 ppm! How can this be explained?

**Problem 15**

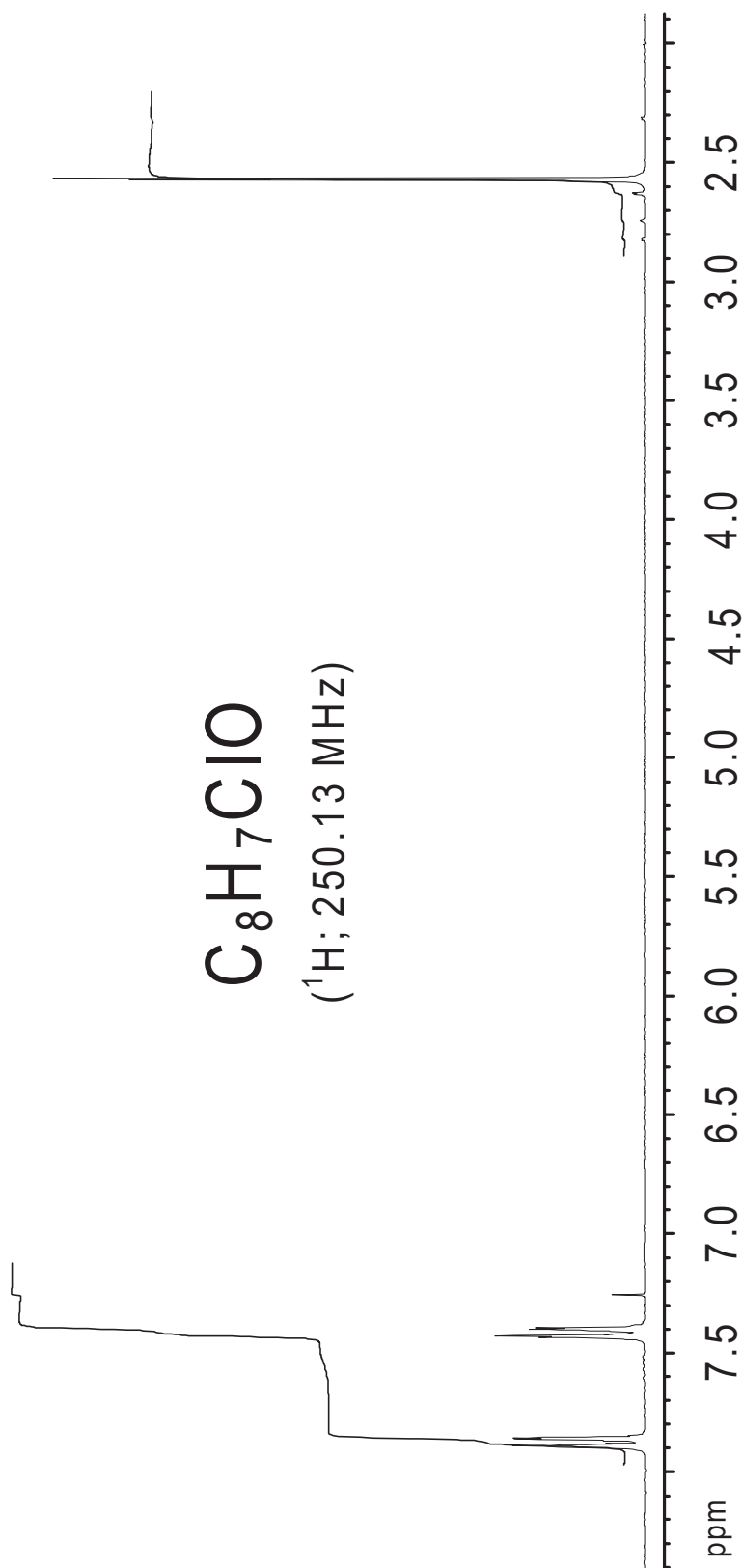
(Translated from Art van der Est)

**Exercises, problem 15:** Determine the structure!



**Problem 16**

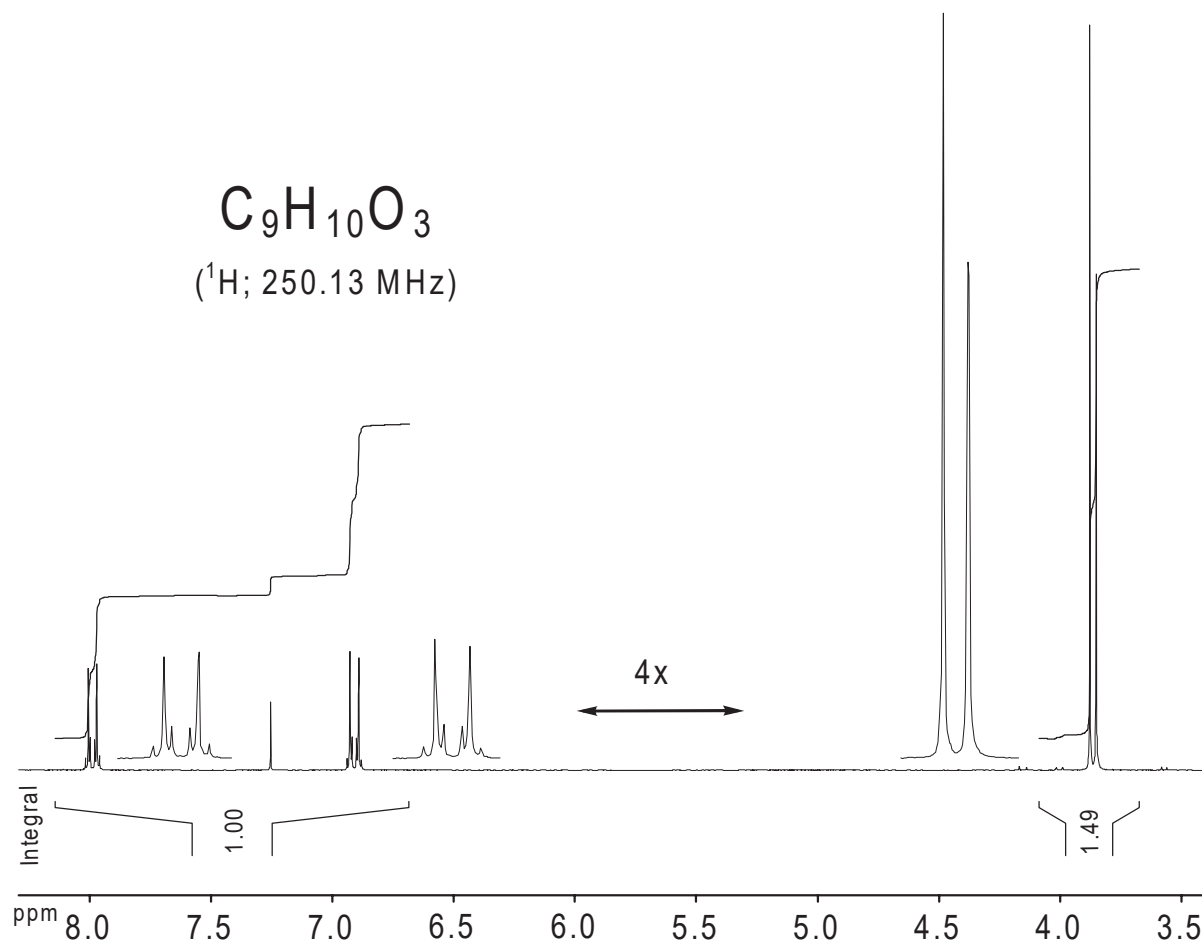
(Translated from Art van der Est)



**Exercises, problem 16:** Determine the structure! Can you distinguish reliably between the two alternative structures?

**Problem 17**

(Translated from Art van der Est)

**Exercises, problem 17:** Determine the structure!

以上内容仅为本文档的试下载部分，为可阅读页数的一半内容。如要下载或阅读全文，请访问：<https://d.book118.com/755132040340011301>