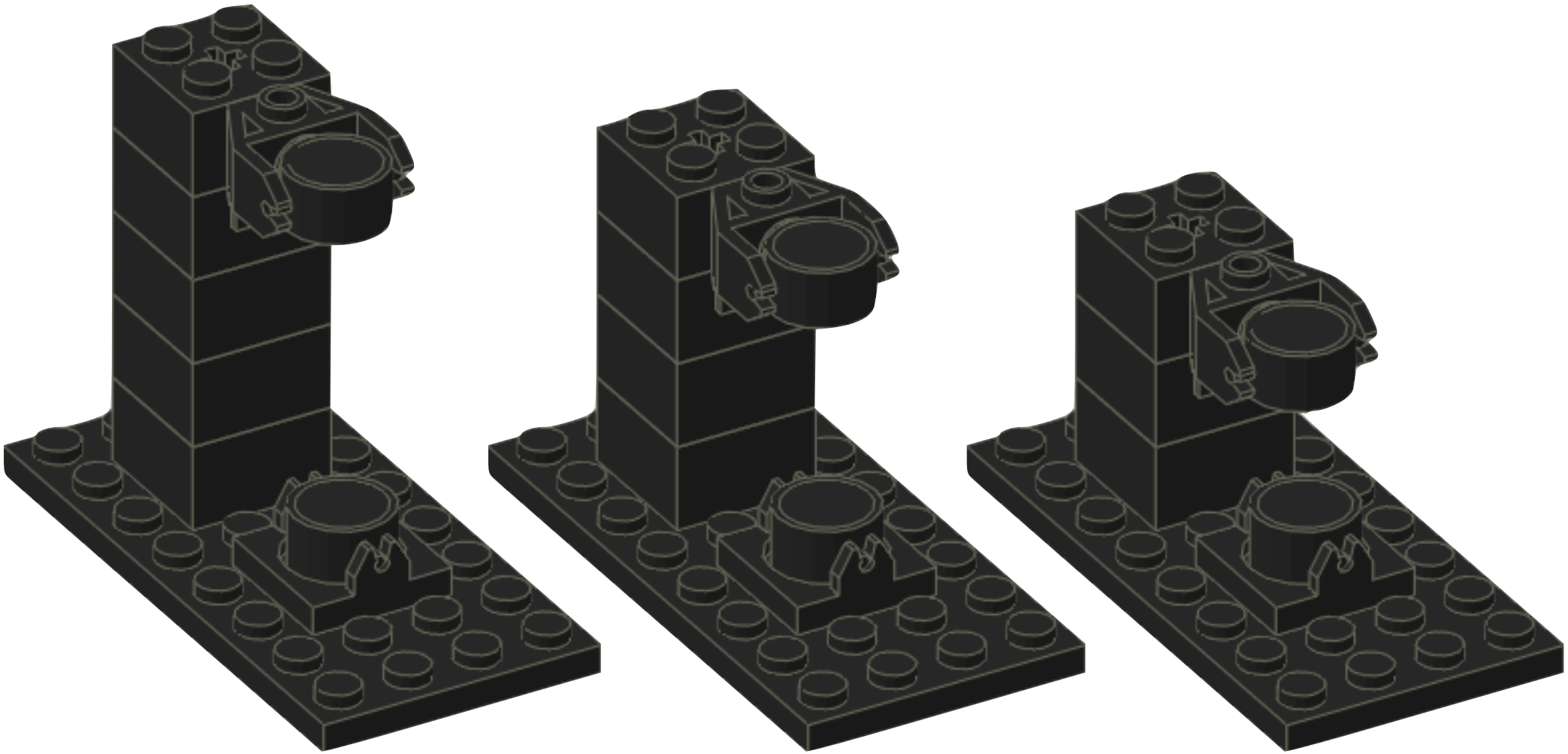
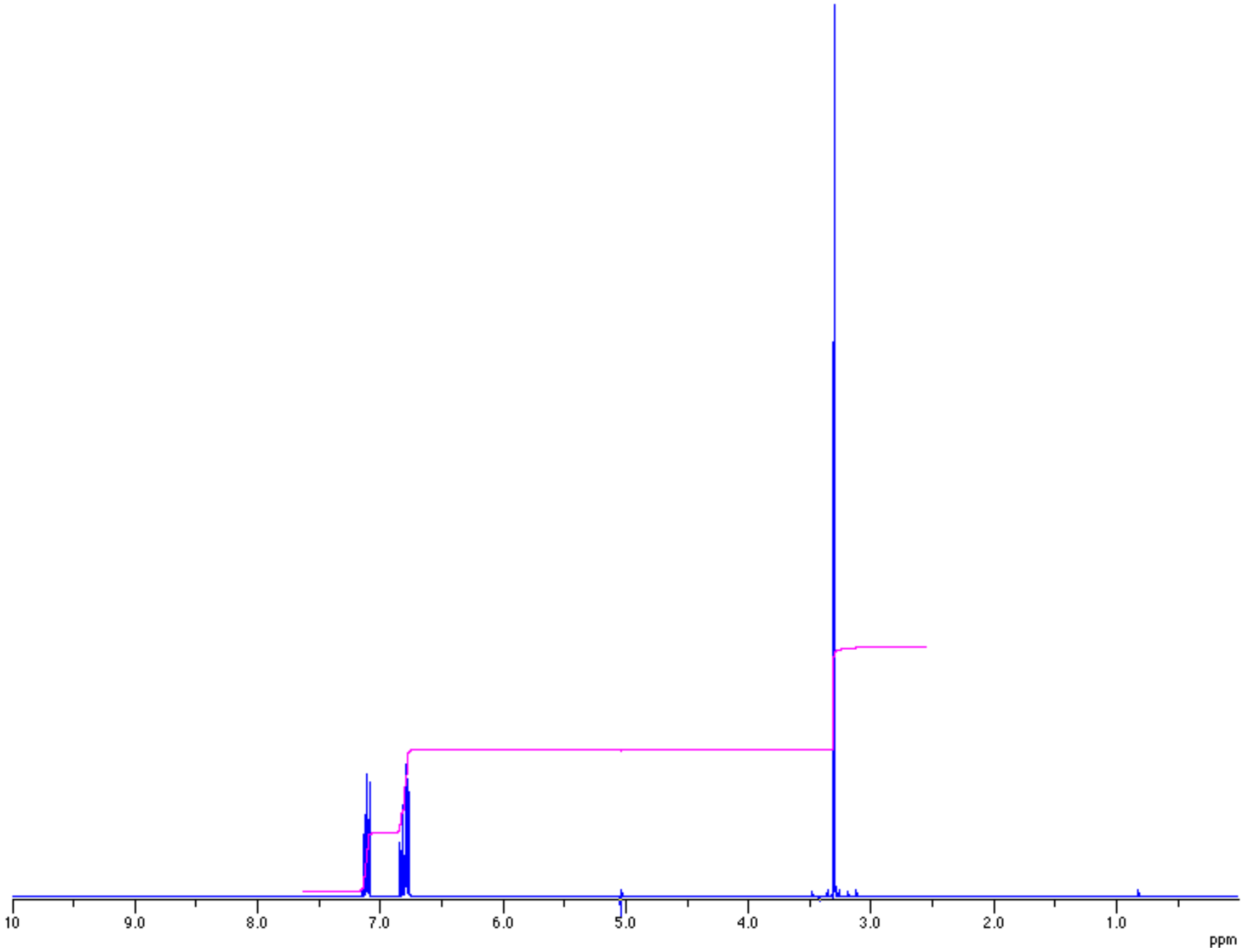
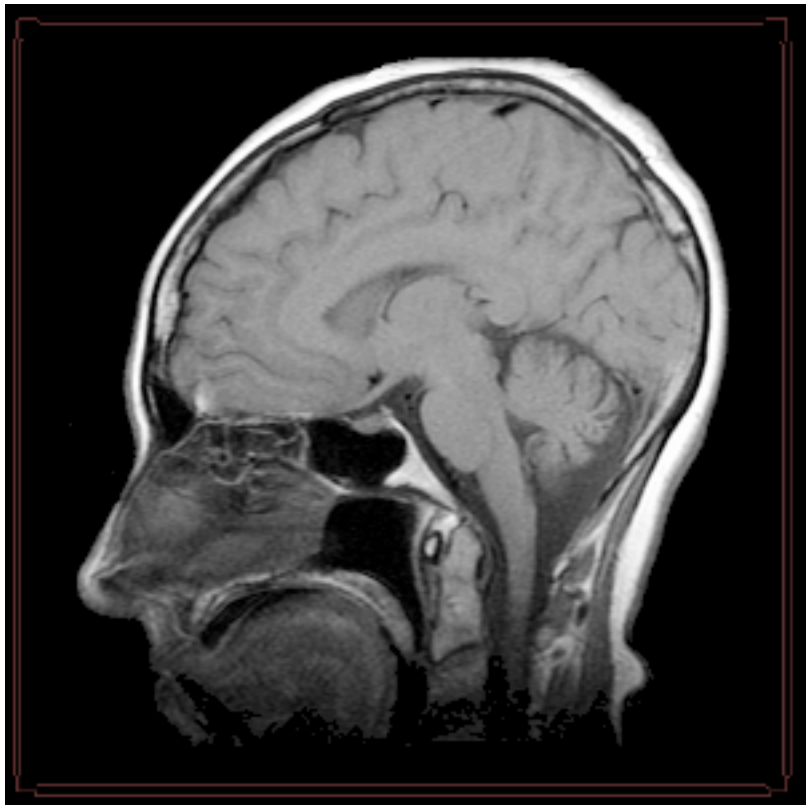


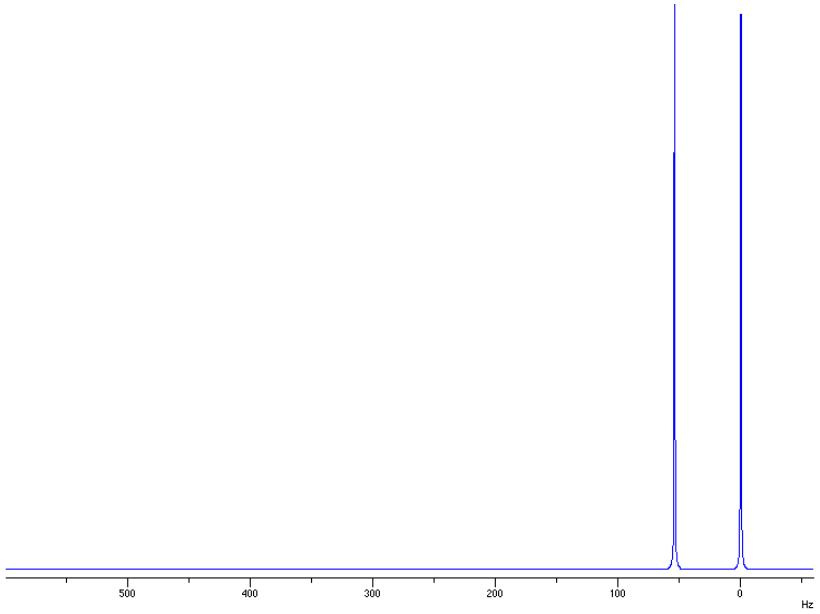
900 MHz, (21.2 T) NMR Magnet at HWB-NMR, Birmingham, UK

https://en.wikipedia.org/wiki/Nuclear_magnetic_resonance#/media/File:HWB-NMR_-_900MHz_-_21.2_Tesla.jpg


10
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
ppm

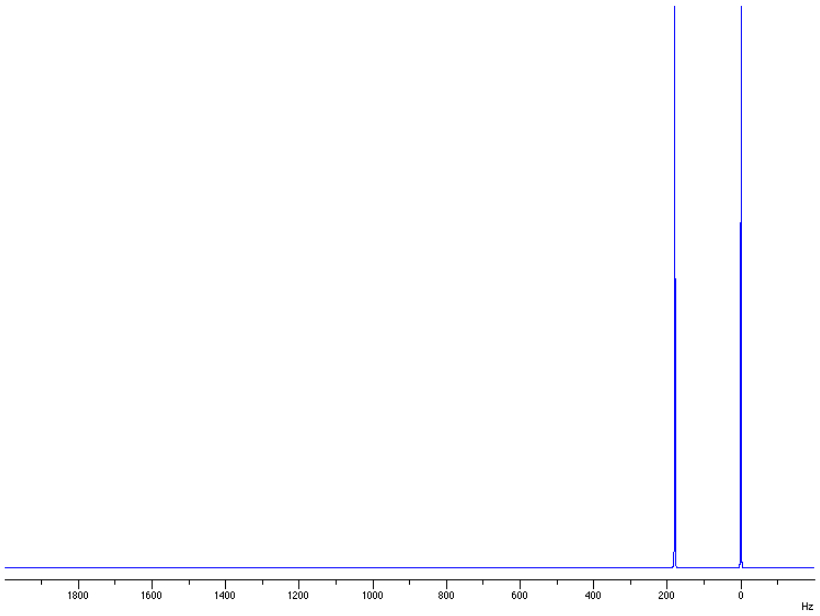
www.radiologyinfo.org





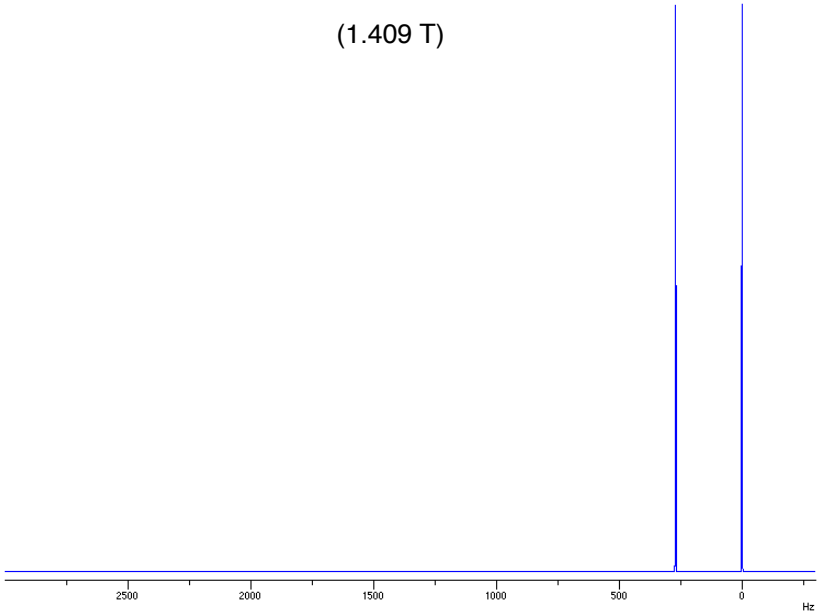
+ 60,000,000 Hz (60 MHz)

(1.409 T)



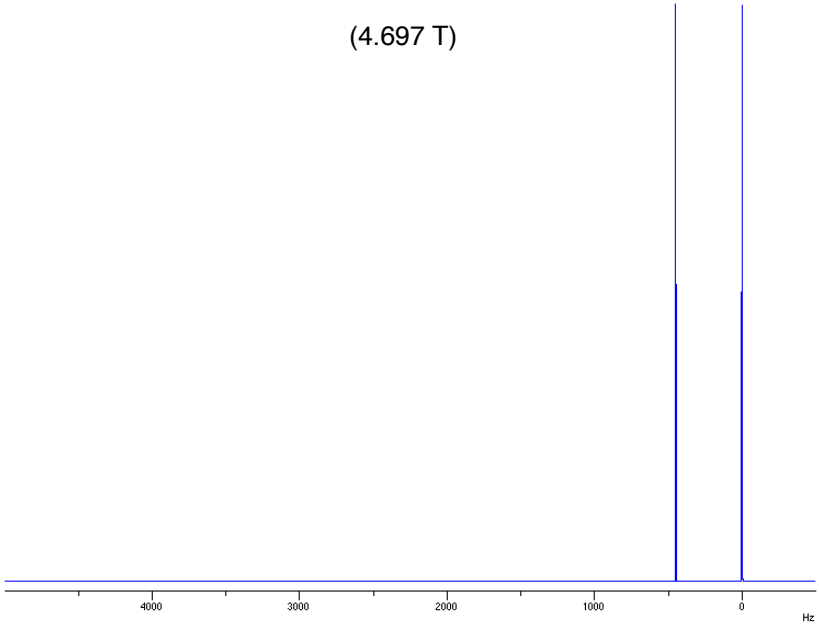
+ 200,000,000 (200 MHz)

(4.697 T)



+300,000,000 Hz (300 MHz)

(7.046 T)

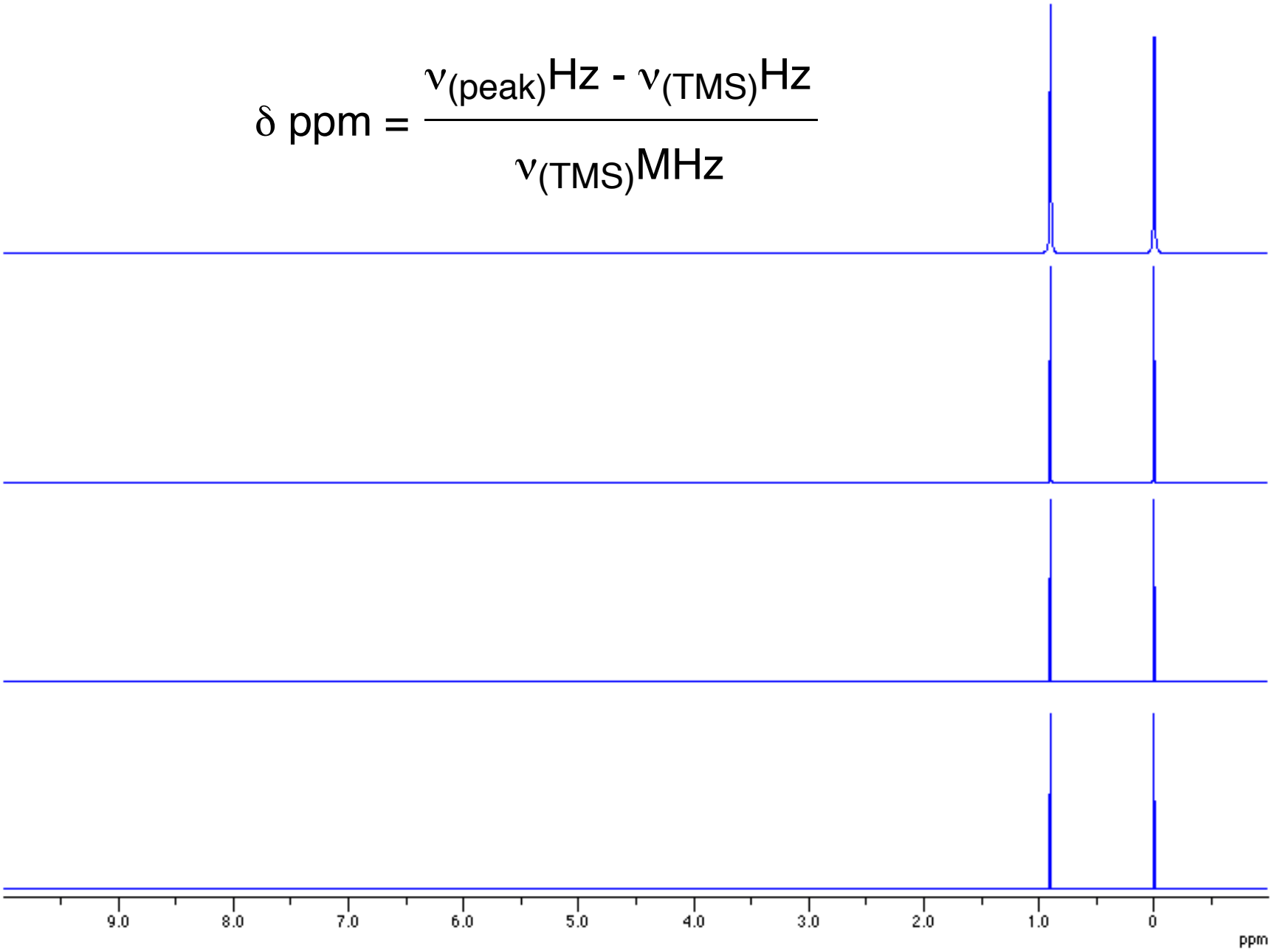


+ 500,000,000 Hz (500 MHz)

(11.743 T)

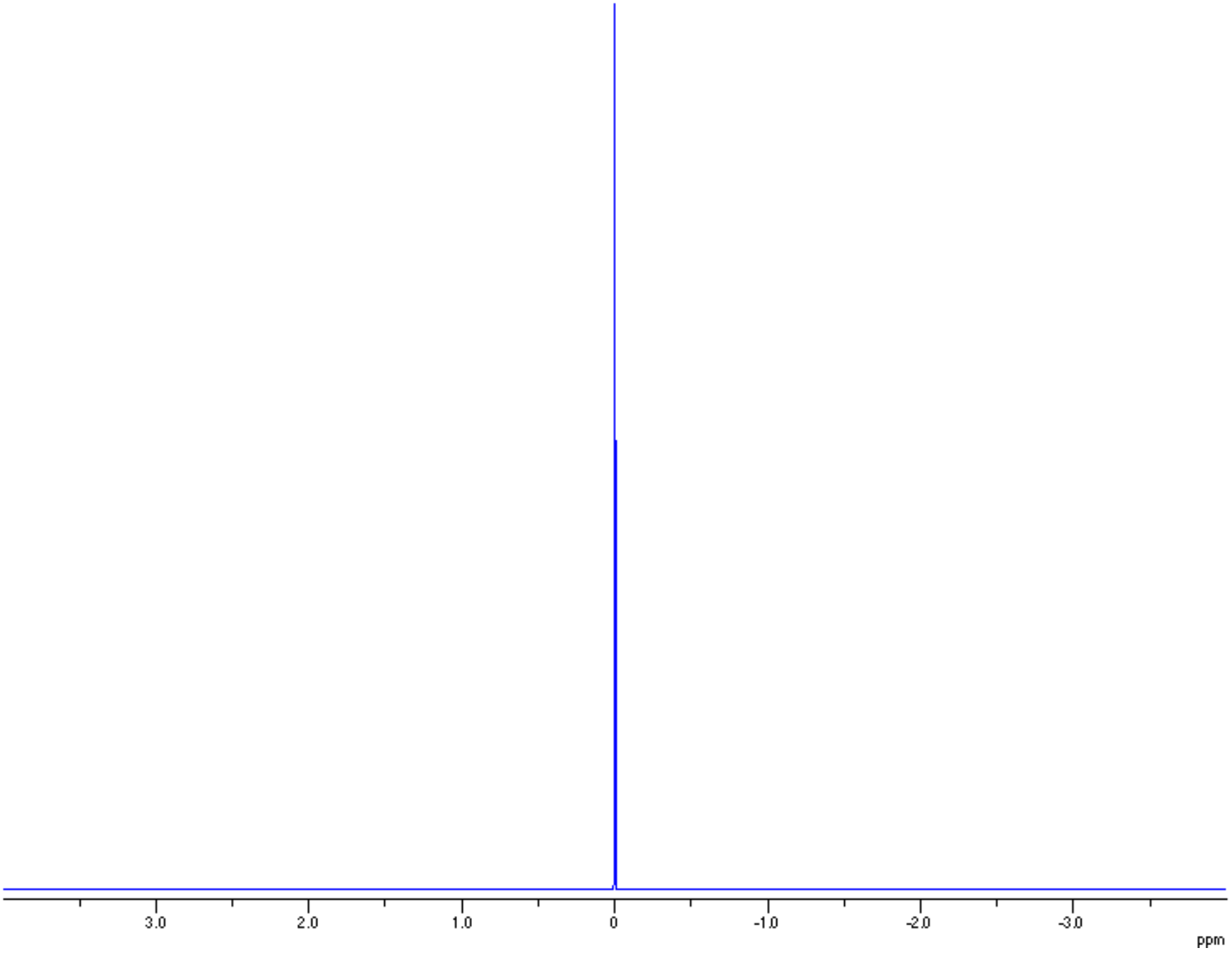
$$\delta \text{ ppm} = \frac{\nu_{(peak)}\text{Hz} - \nu_{(TMS)}\text{Hz}}{\nu_{(TMS)}\text{MHz}}$$

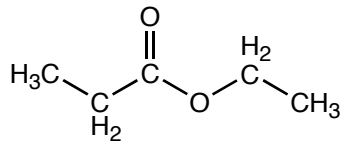
$$\delta \text{ ppm} = \frac{\nu_{(peak)}\text{Hz} - \nu_{(TMS)}\text{Hz}}{\nu_{(TMS)}\text{MHz}}$$



What gives rise to differences in chemical shift?

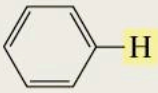
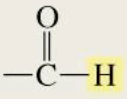
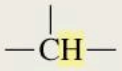
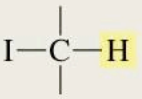
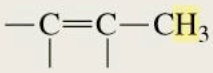
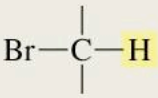
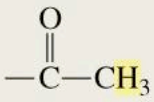
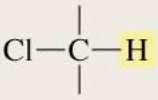
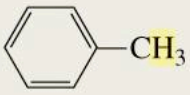
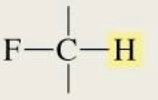
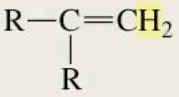
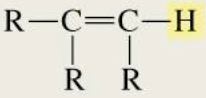
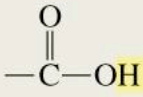
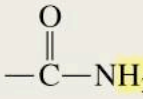
Why do the H's of tetramethylsilane resonate at a different frequency than 2,2-dimethylpropane?


3.0
2.0
1.0
0
-1.0
-2.0
-3.0
ppm

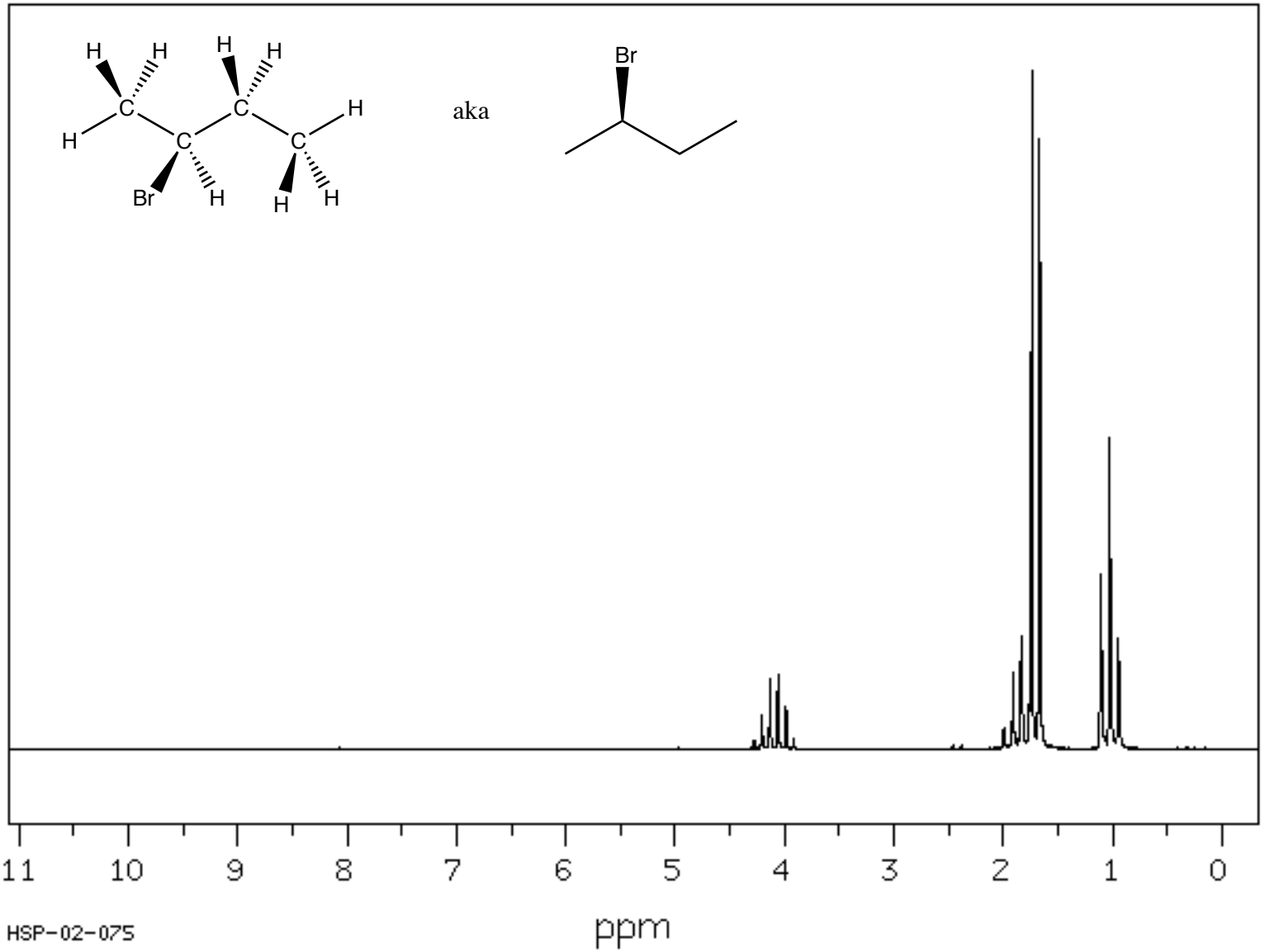

O
H2
H3C
C
C
O
C
CH3
H2

9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
ppm

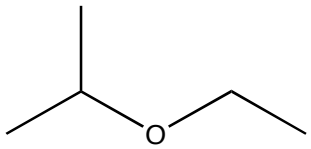
Table 14.1 Approximate Values of Chemical Shifts for ^1H NMR[a]

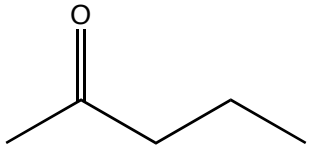
Type of proton	Approximate chemical shift (ppm)	Type of proton	Approximate chemical shift (ppm)
$(CH_3)_4Si$	0		6.5–8
$-CH_3$	0.9		
$-CH_2-$	1.3		9.0–10
	1.4		2.5–4
	1.7		
			2.5–4
	2.1		
			3–4
	2.3		
			4–4.5
$-C\equiv C-H$	2.4		
$R-O-CH_3$	3.3	RNH_2	Variable, 1.5–4
	4.7	ROH	Variable, 2–5
		ArOH	Variable, 4–7
	5.3		Variable, 10–12
			Variable, 5–8

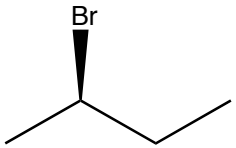
[a]The values are approximate because they are affected by neighboring substituents.

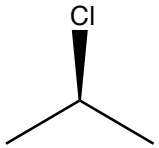


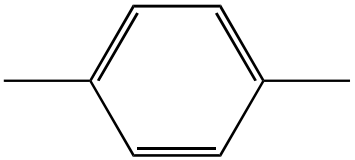
https://sdbs.db.aist.go.jp/sdbs/cgi-bin/landingpage?sdbsno=500

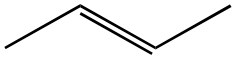

O


O


Br

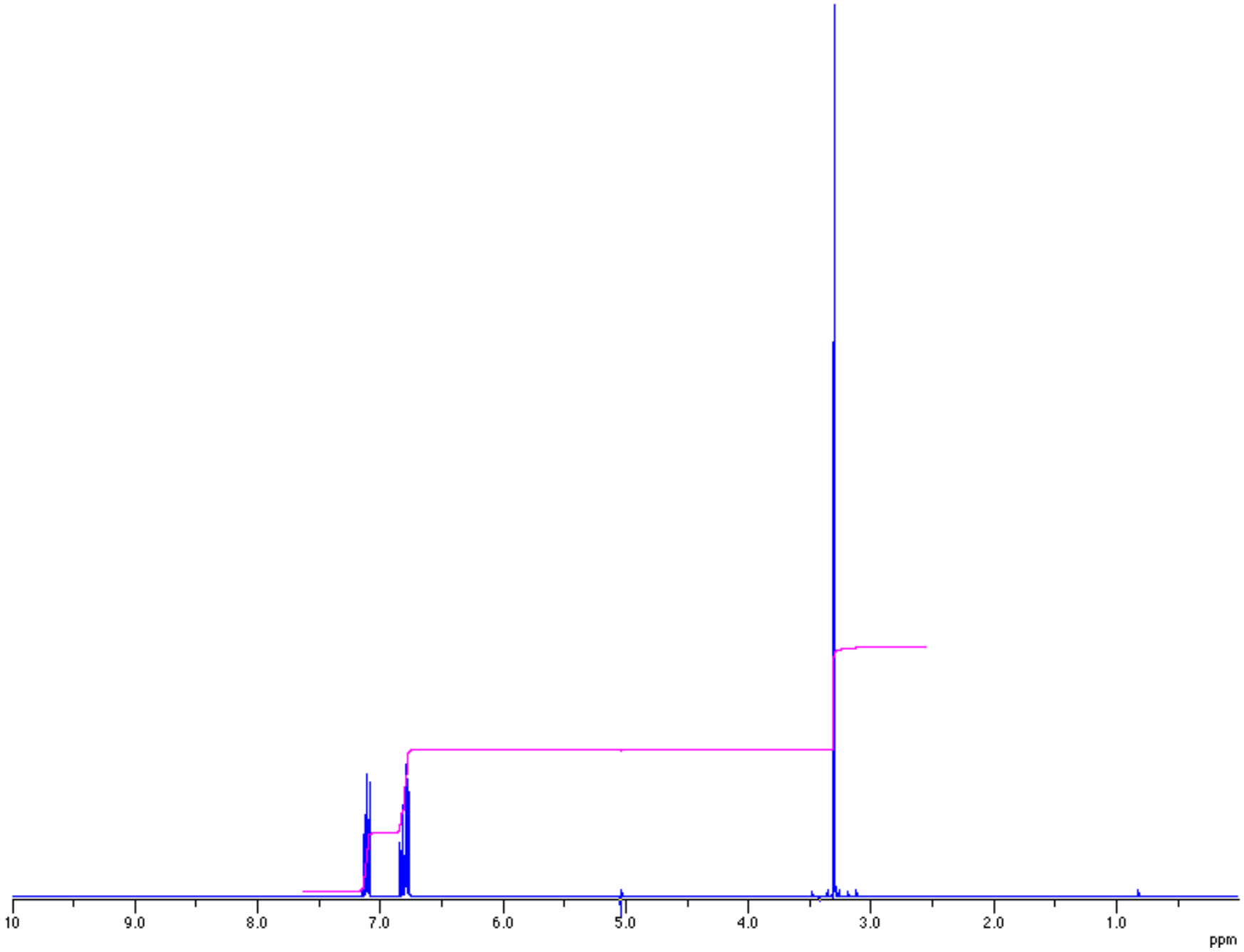

Cl

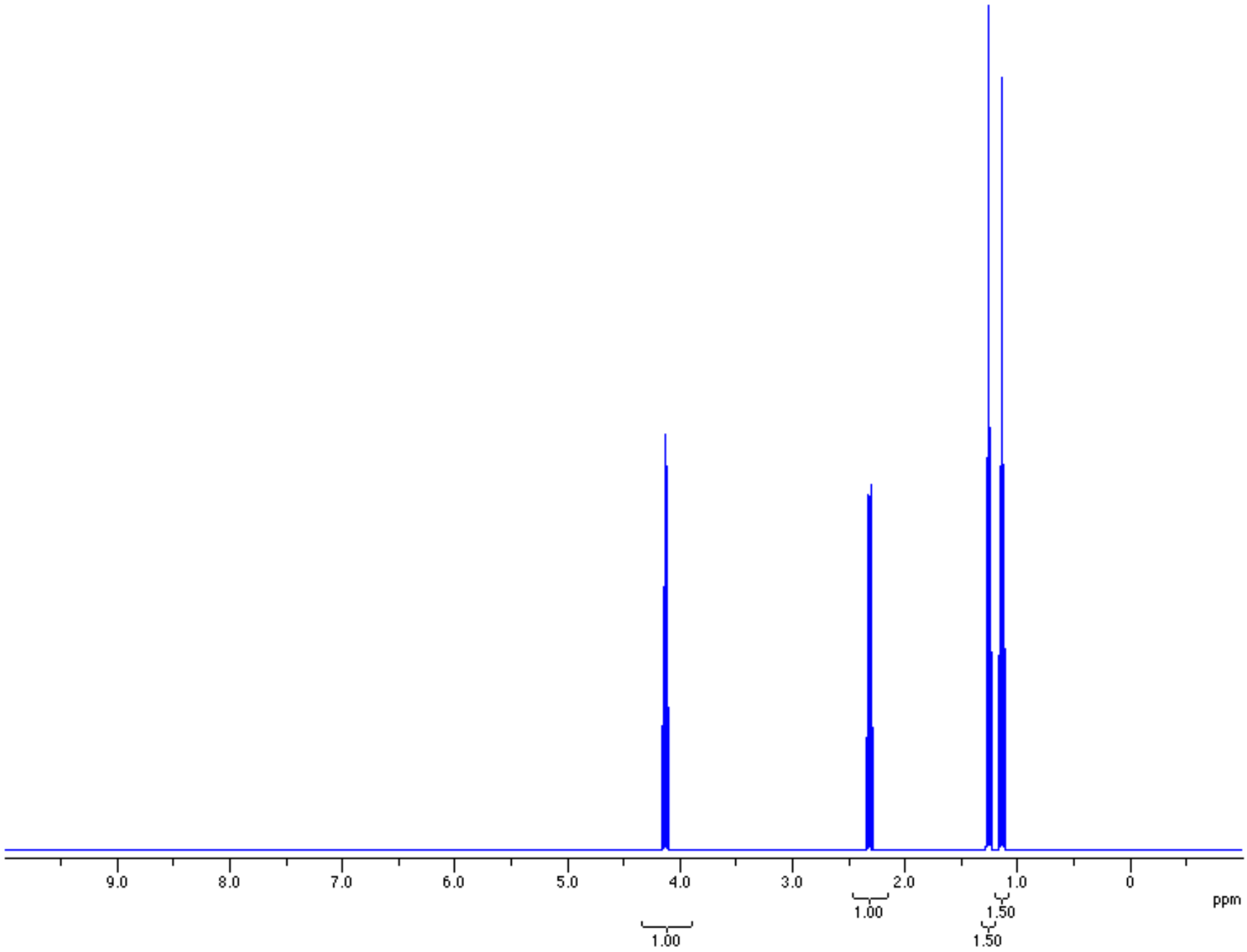




Number of different types of H atoms

Chemical environments of the H atoms

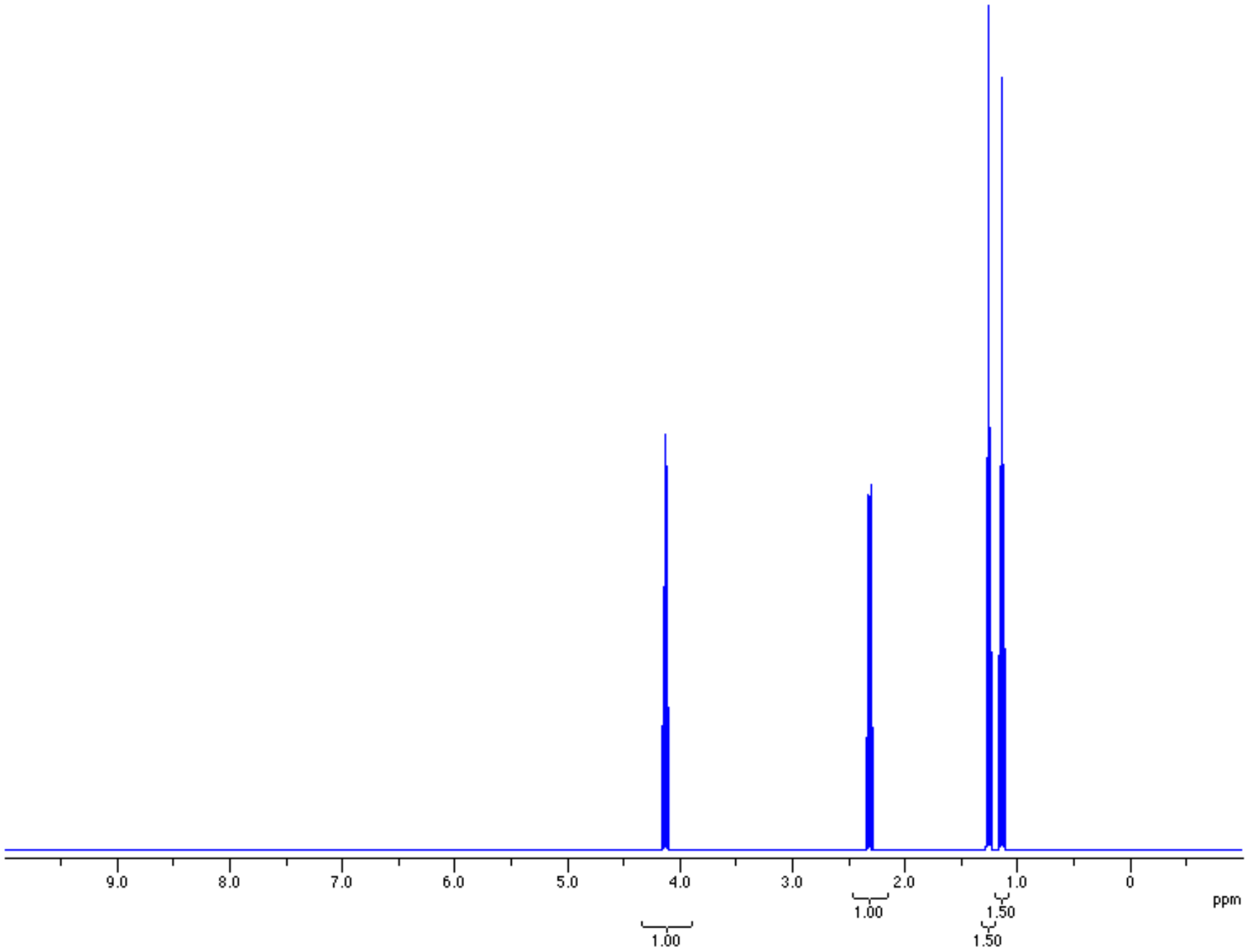

10
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
ppm

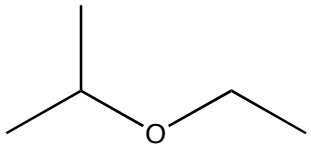

9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
ppm
1.00
1.00
1.50
1.50

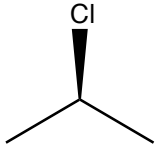
Number of different types of H atoms

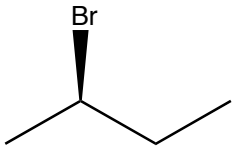
Chemical environments of the H atoms

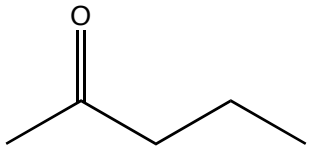
How many of each type of H atom

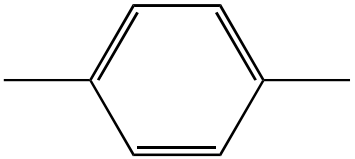

9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
ppm
1.00
1.00
1.50
1.50

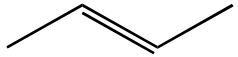

O


Cl


Br


O





Number of different types of H atoms

Chemical environments of the H atoms

How many of each type of H atom

How many H atoms neighbor each different type of H atom