



Ressonância Magnética Nuclear - RMN

Espectroscopia

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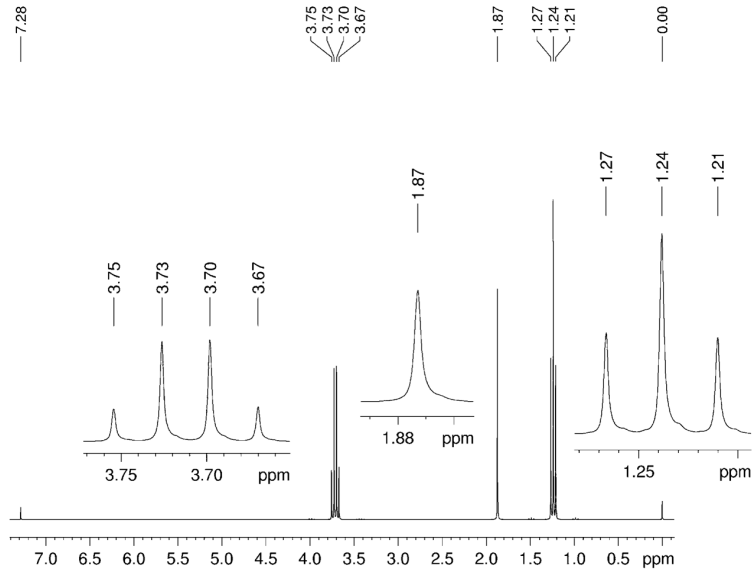
1. Equivalência Química e Magnética
2. Acoplamentos em Sistemas Aromáticos
3. Exercícios - Espectros dos Isômeros da Dicloroanilina
4. Exercícios - Espectros dos Isômeros da Tricloroanilina

Equivalência Química e Magnética

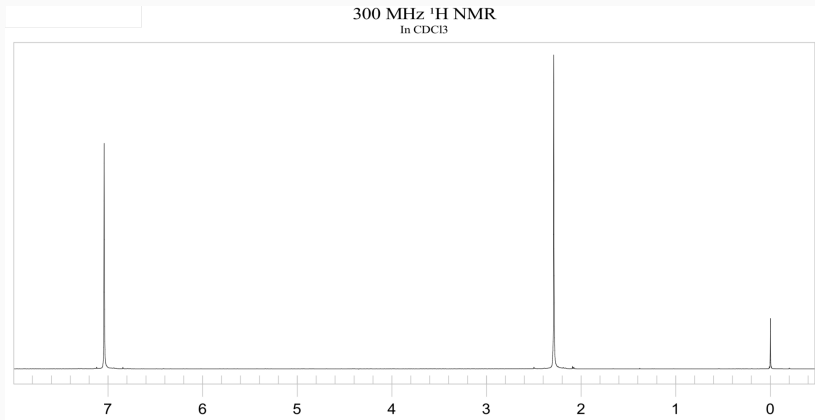
Equivalência Química e Magnética

- Sinais quimicamente equivalentes
 - ambiente químico idênticos
 - têm mesmo δ
 - única frequência ν
 - sem J ou com J iguais
 - magneticamente equivalente
 - quando há J diferentes
 - magneticamente não equivalente
- Sinais quimicamente não equivalentes
 - δ diferente
 - há J diferentes
 - magneticamente não equivalentes

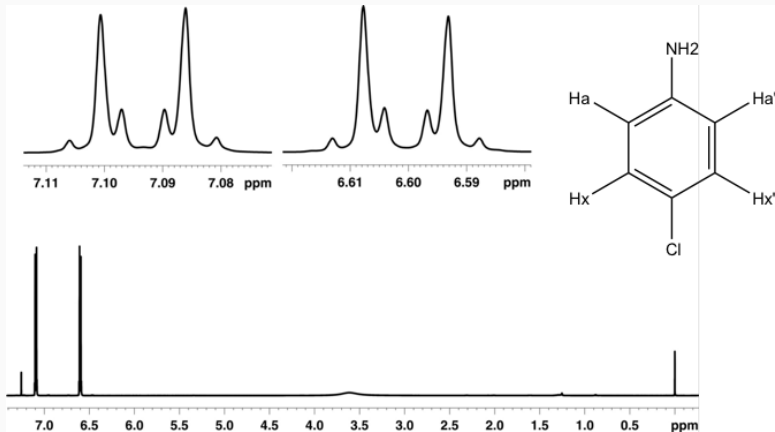
Quimicamente e Magneticamente Equivalentes - Etanol



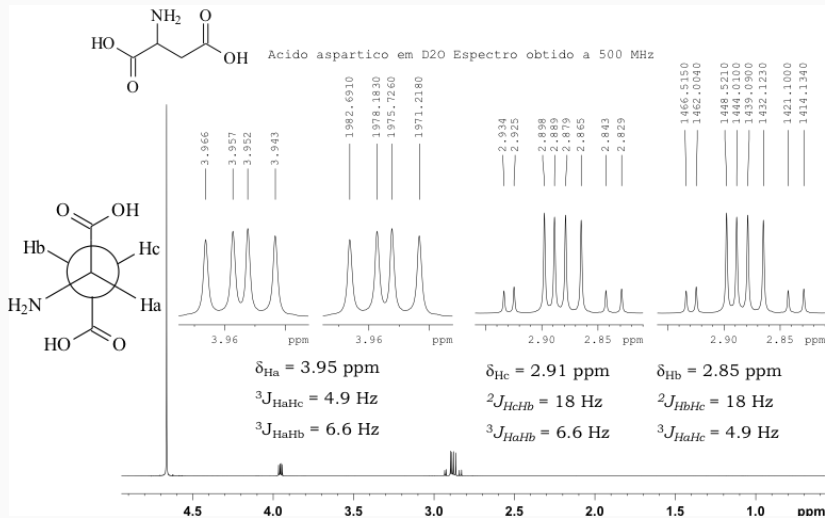
Quimicamente e Magneticamente Equivalentes - p-Xileno



Quimicamente Equivalentes e Magneticamente Não Equivalentes- p-Cl-Anilina

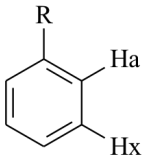


Quimicamente e Magneticamente Não Equivalentes - Ácido Aspártico



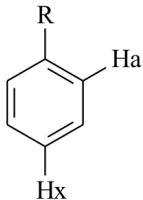
Acoplamentos em Sistemas Aromáticos

Tipos de Acoplamentos de ^1H



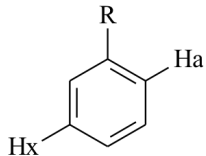
Orto

$$^3J_{HH} = 6-10 \text{ Hz}$$



Meta

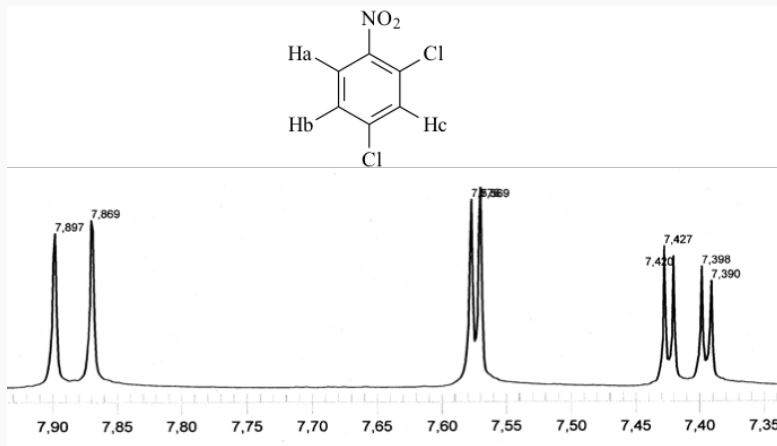
$$^4J_{HH} = 1-3 \text{ Hz}$$



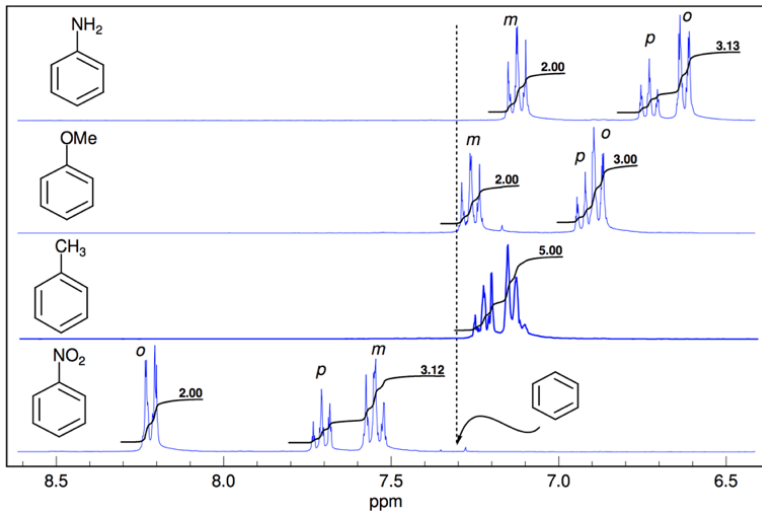
Para

$$^5J_{HH} = 0-1 \text{ Hz}$$

Sinais Quimicamente e Magneticamente Não Equivalentes- o- p-Cl,Cl-Nitro Benzeno

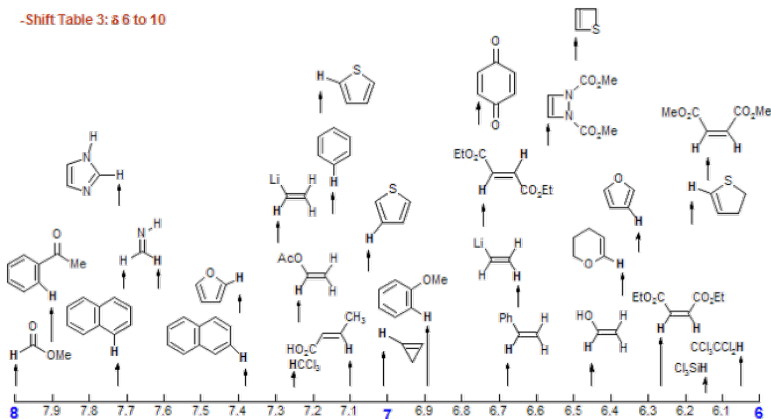


Padrão de Acoplamentos em Benzenos Substituídos

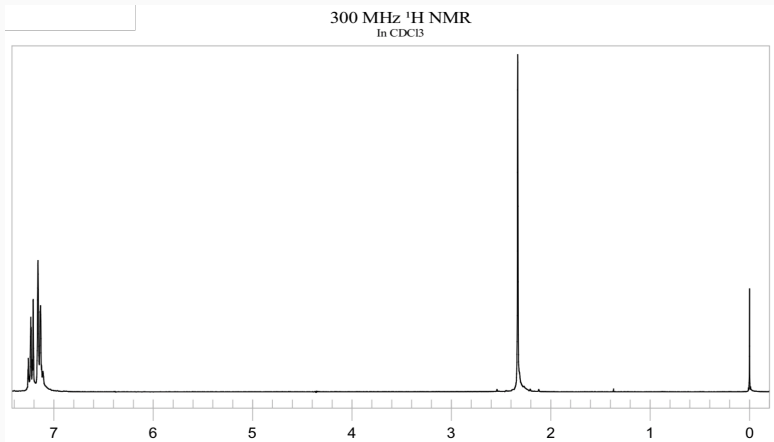


Escala de Deslocamento Químico dos Aromáticos

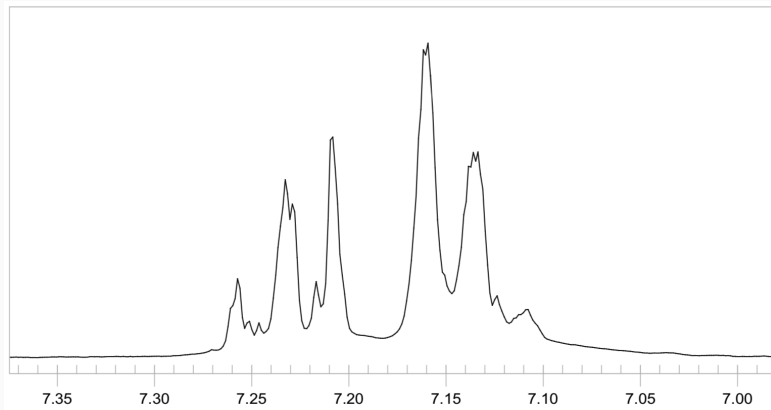
-Shift Table 3: δ 6 to 10



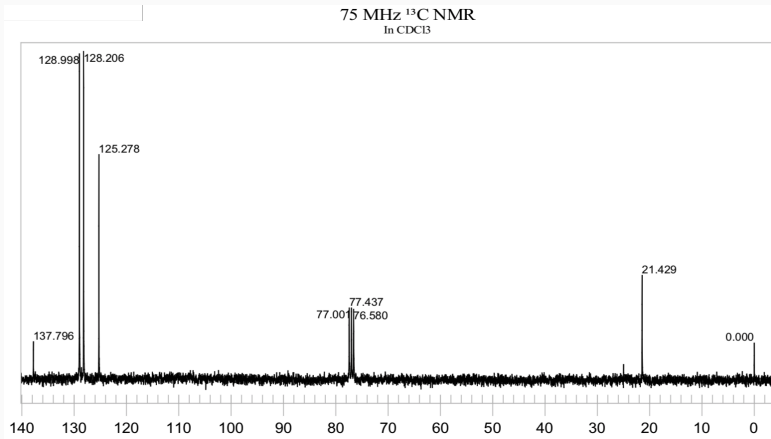
Espectro de ^1H do Tolueno



Espectro de ^1H do Tolueno

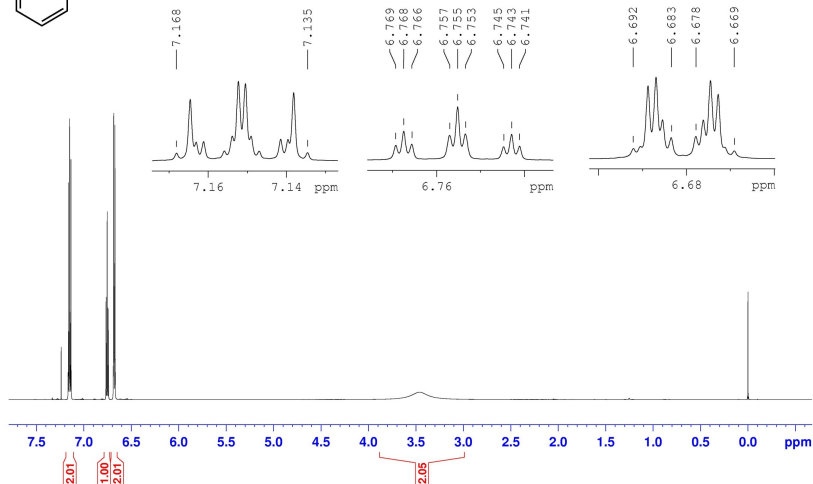


Espectro de ^{13}C do Tolueno



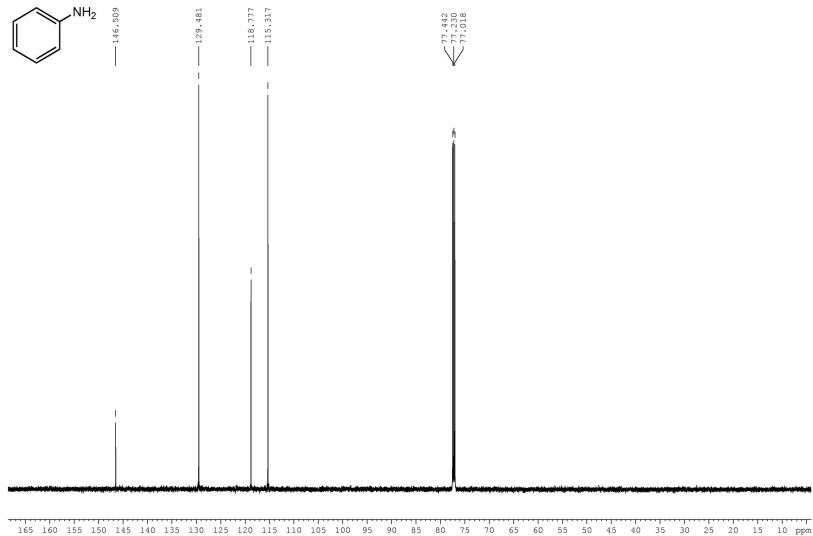
Espectro de ^1H da Anilina

Anilina 600MHz CDCl_3



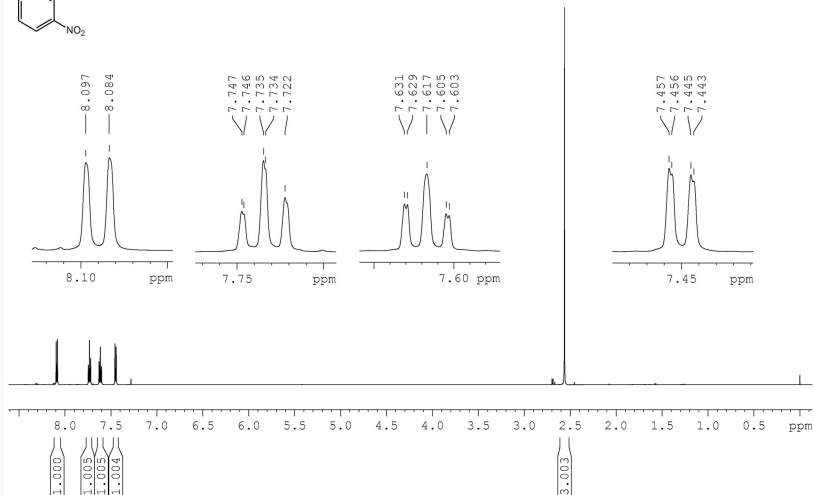
Espectro de ^{13}C da Anilina

Anilina 600MHz CDCl₃



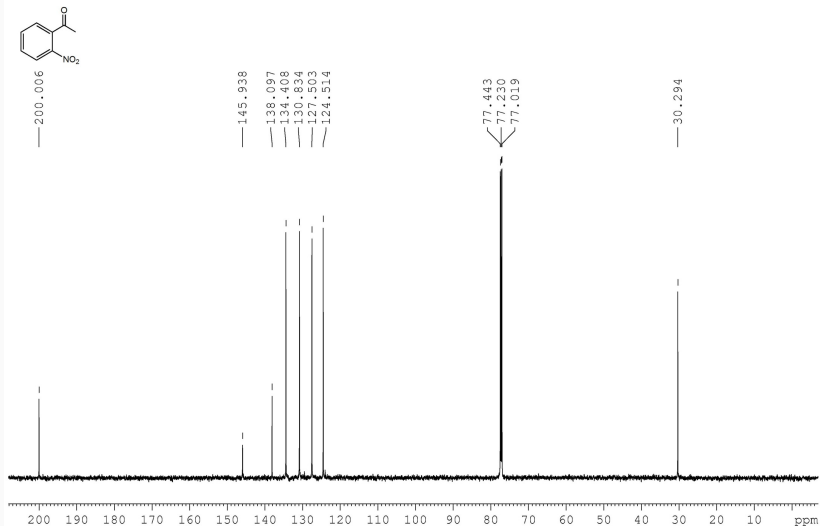
Espectro de ^1H da 2-Nitroacetofenona

2-nitroacetophenone 600MHz CDCl₃



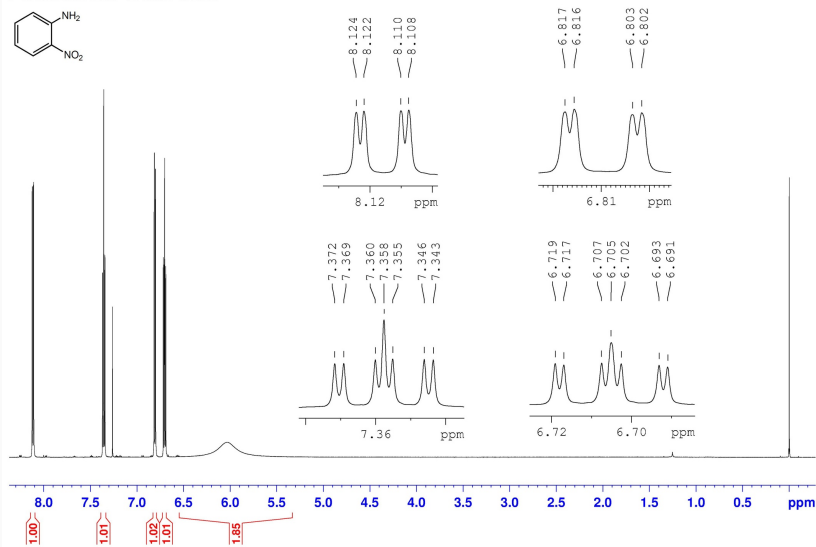
Espectro de ^{13}C da 2-Nitroacetofenona

2-nitroacetophenone 600MHz CDCl₃



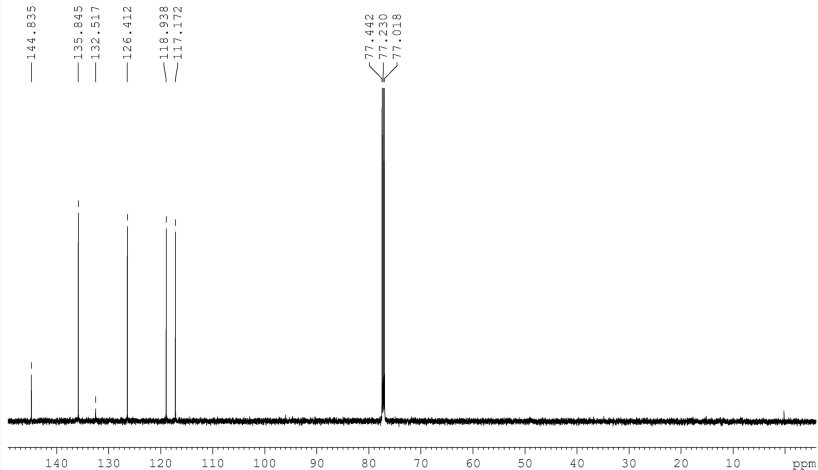
Espectro de ^1H da o-Nitroanilina

o-nitroanilina 600MHz CDCl₃

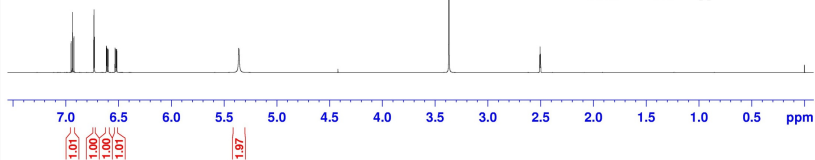
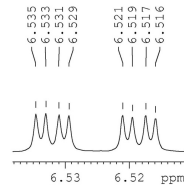
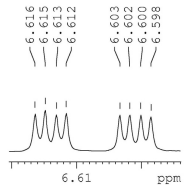
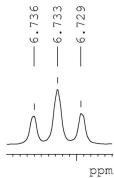
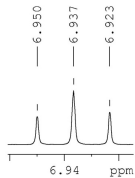
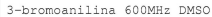


Espectro de ^{13}C da o-Nitroanilina

o-nitroanilina 600MHz CDCl₃

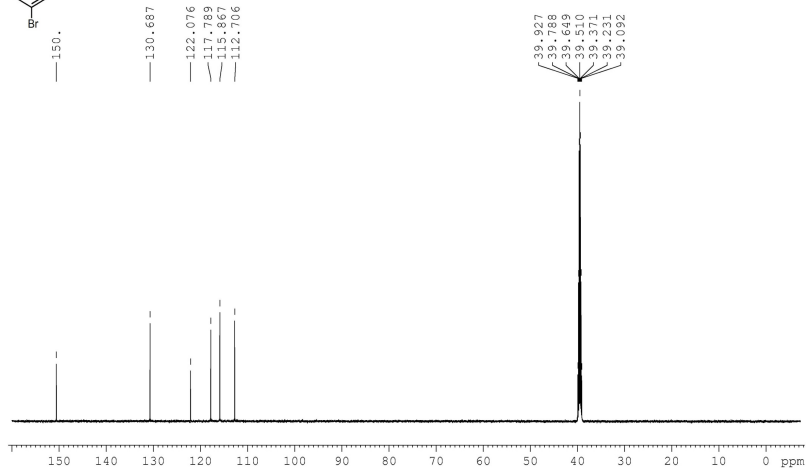


Espectro de ^1H da 3-Bromoanilina



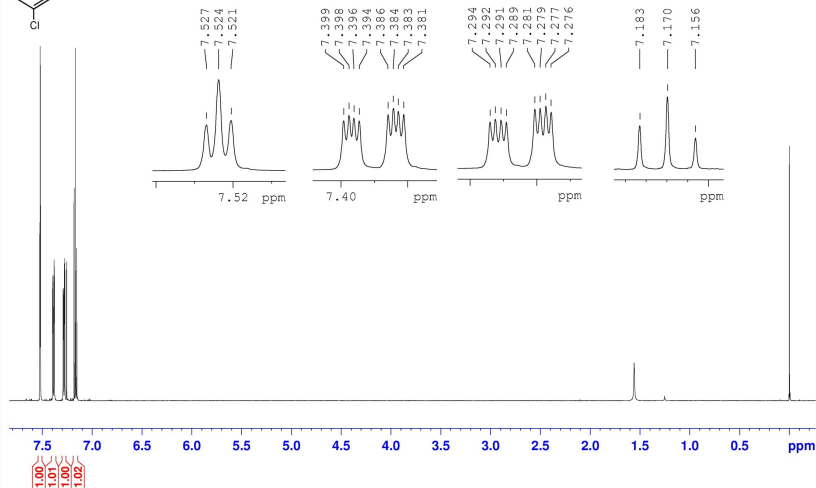
Espectro de ^{13}C da 3-Bromoanilina

3-bromoanilina 600MHz DMSO



Espectro de ^1H do 3-Bromo-clorobenzeno

3-bromoclorobenzeno 600MHz CDC13



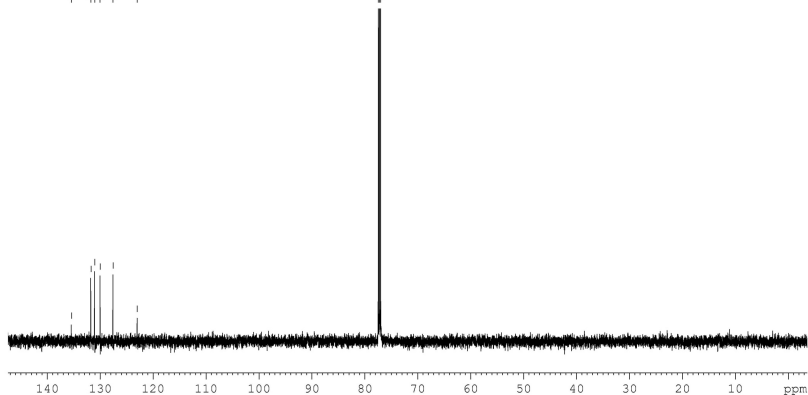
Espectro de ^{13}C do 3-Bromo-clorobenzeno

3-bromoclorobenzeno 600MHz CDCl_3



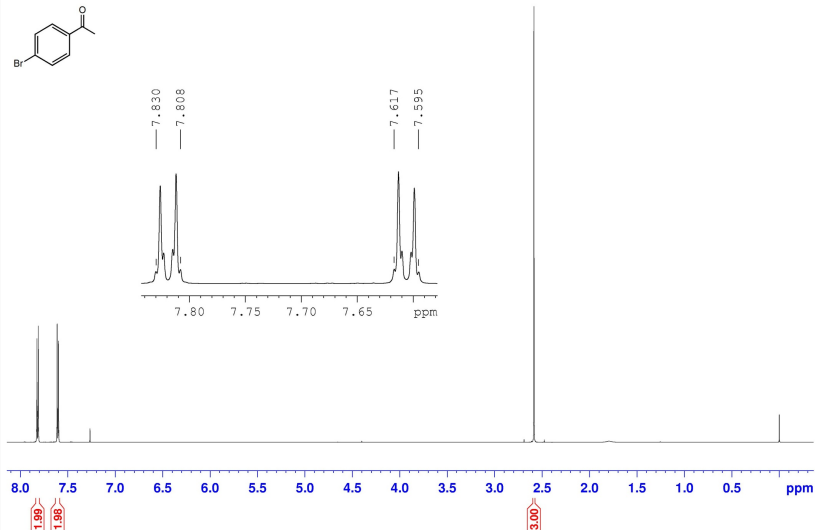
135.404
131.724
131.003
130.011
127.571
123.013

77.438
77.226
77.015



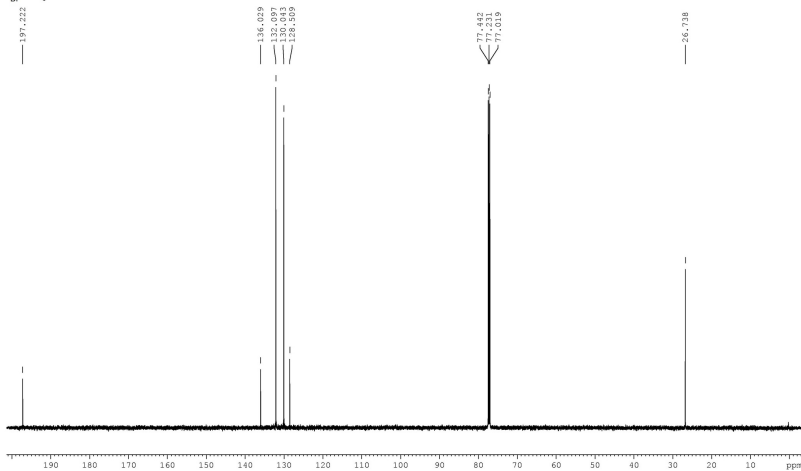
Espectro de ^1H do 4-Bromoacetofenona

4-bromoacetofenona 600MHz CDCl_3



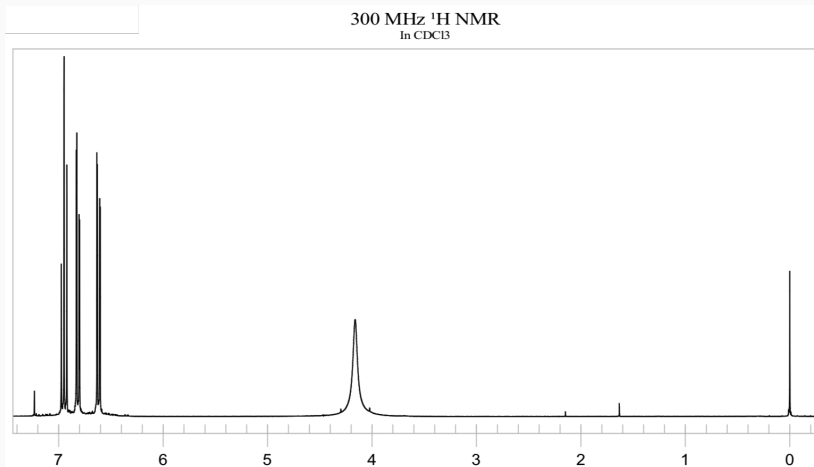
Espectro de ^{13}C do 4-Bromoacetofenona

4-bromoacetofenona 600MHz CDCl₃

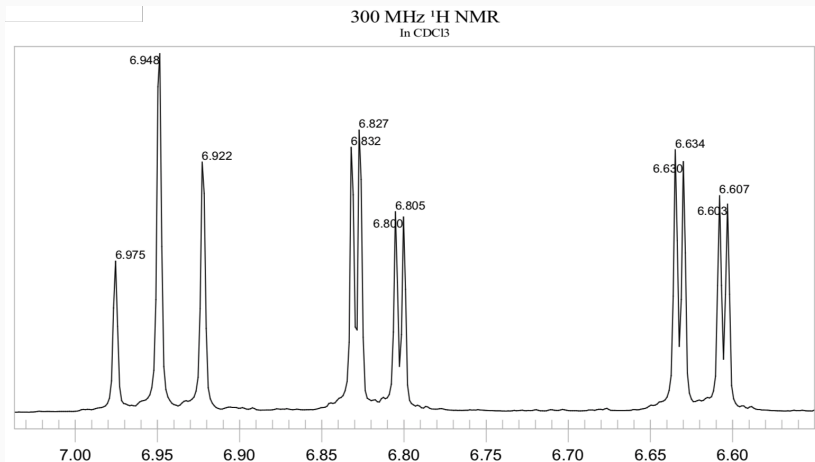


Exercícios - Espectros dos Isômeros da Dicloroanilina

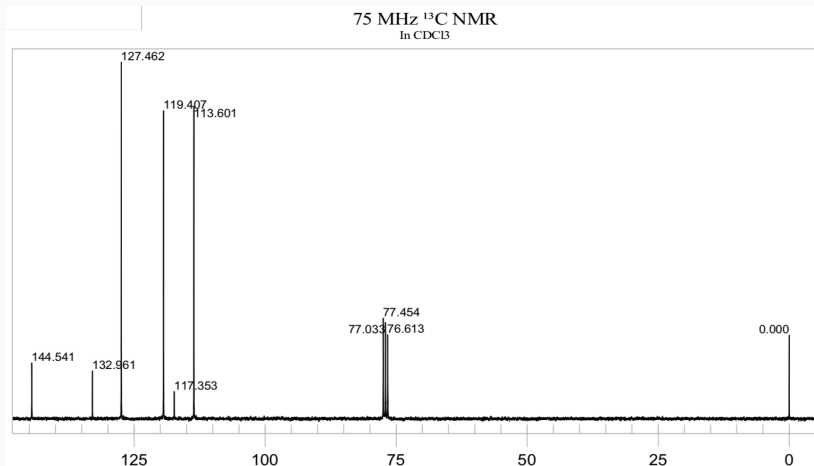
Exercício 1 - Espectro de ^1H



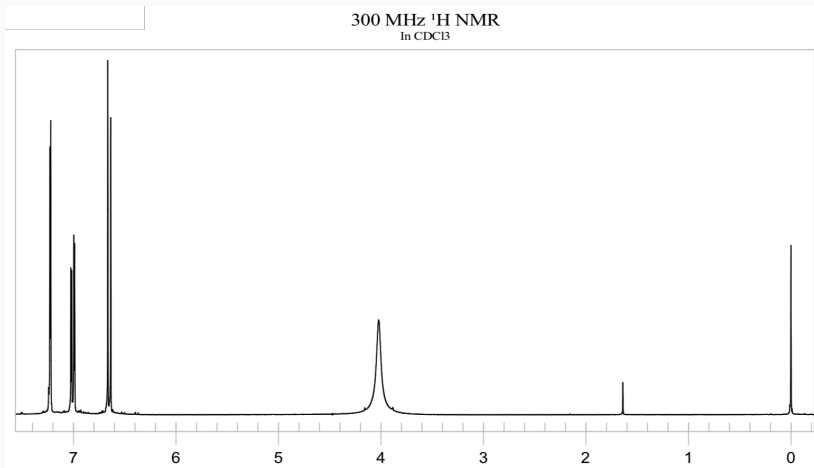
Exercício 1 - Espectro de ^1H : Expansão dos Sinais Aromáticos



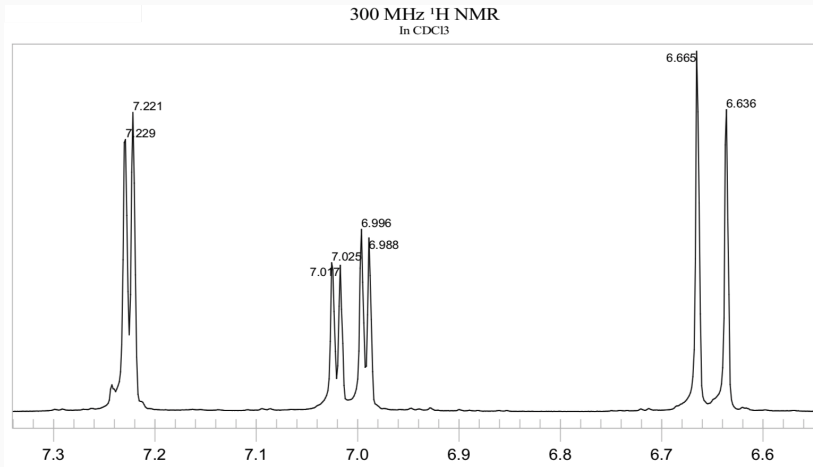
Exercício 1 - Espectro de ^{13}C



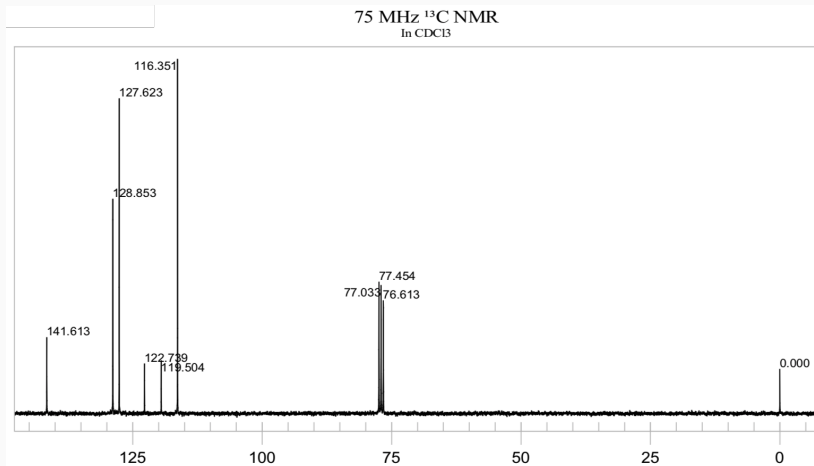
Exercício 2 - Espectro de ^1H



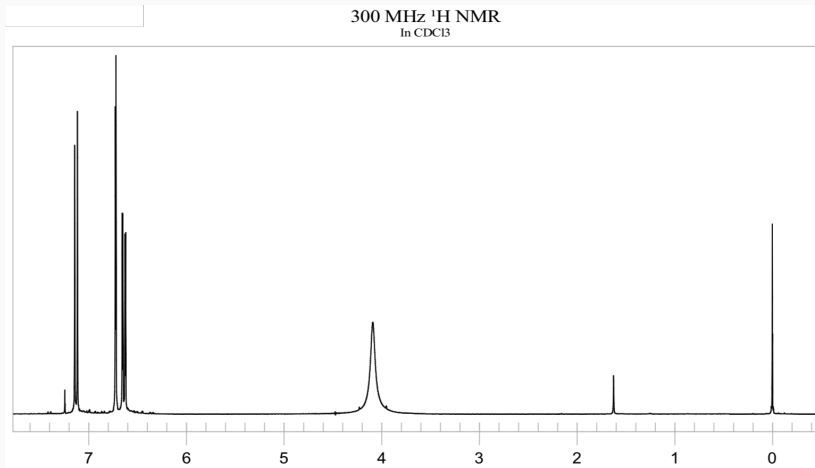
Exercício 2 - Espectro de ^1H : Expansão dos Sinais Aromáticos



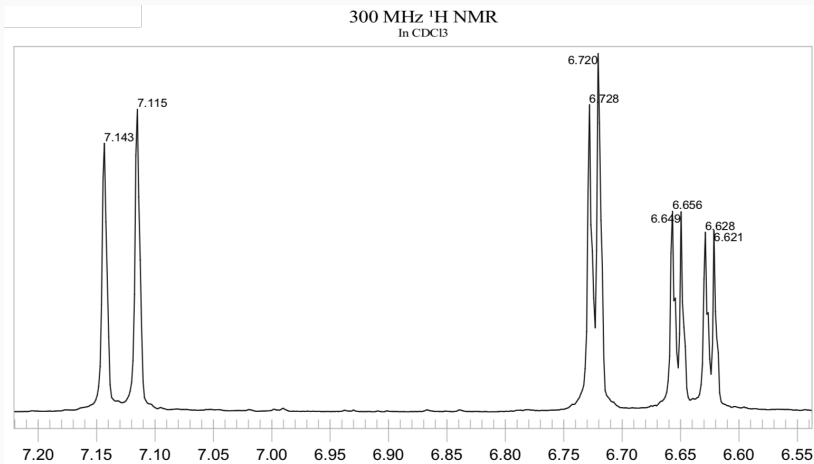
Exercício 2 - Espectro de ^{13}C



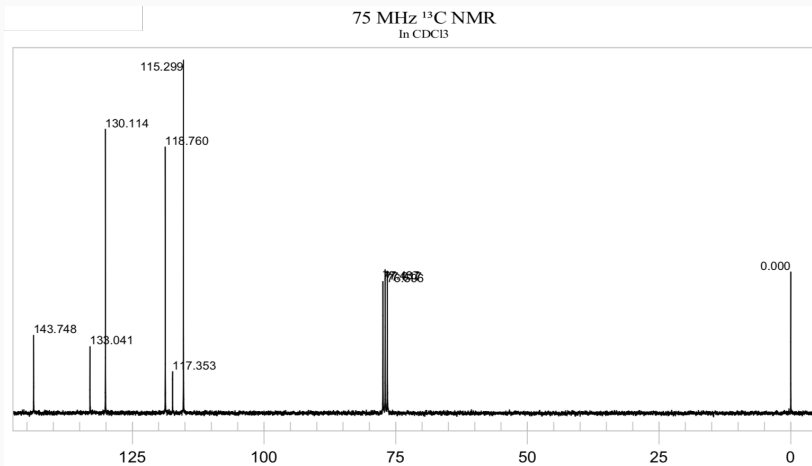
Exercício 3 - Espectro de ^1H



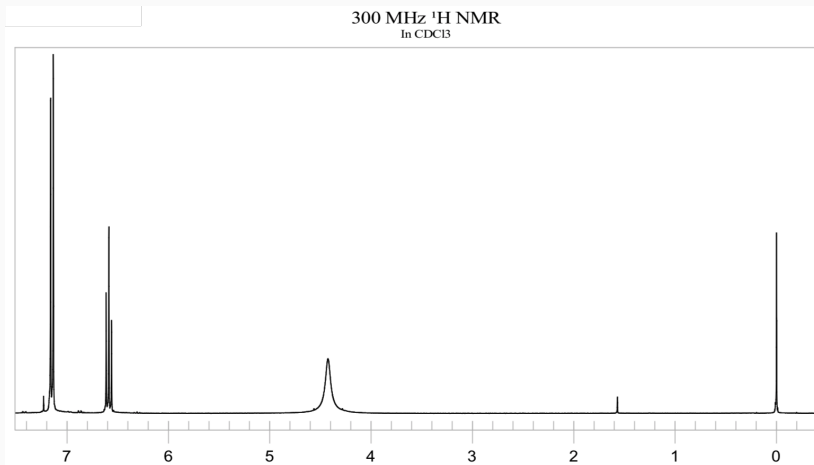
Exercício 3 - Espectro de ^1H : Expansão dos Sinais Aromáticos



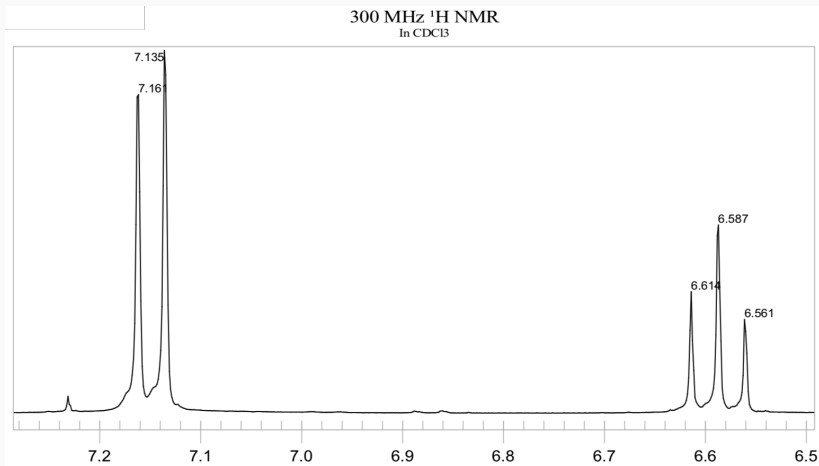
Exercício 3 - Espectro de ^{13}C



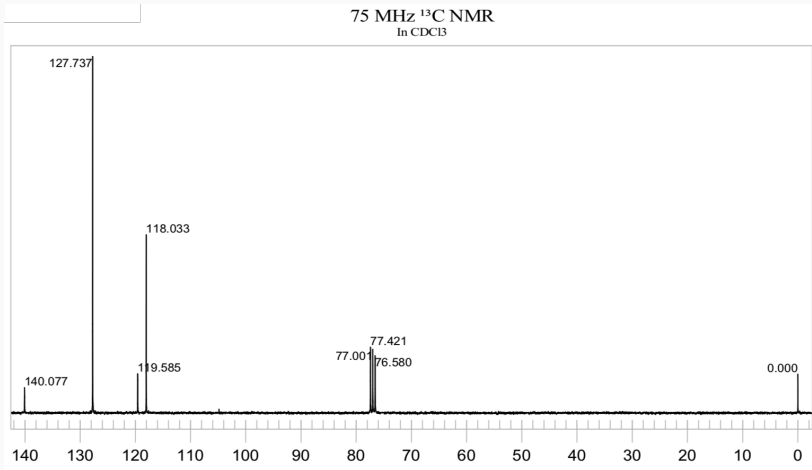
Exercício 4 - Espectro de ^1H



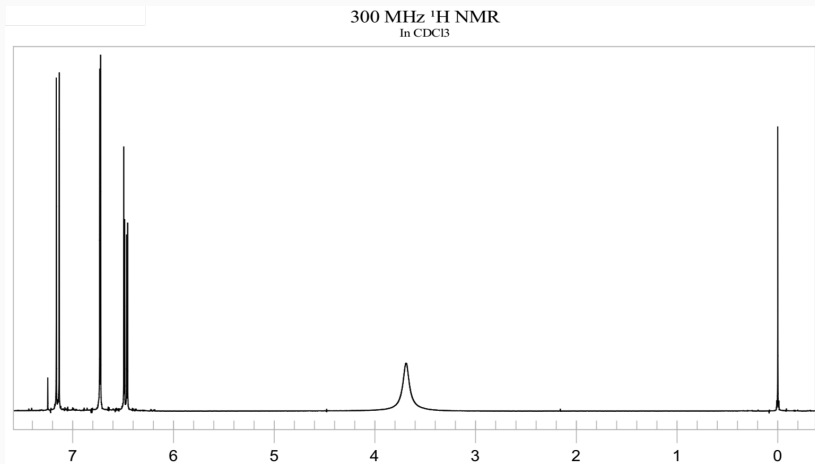
Exercício 4 - Espectro de ^1H : Expansão dos Sinais Aromáticos



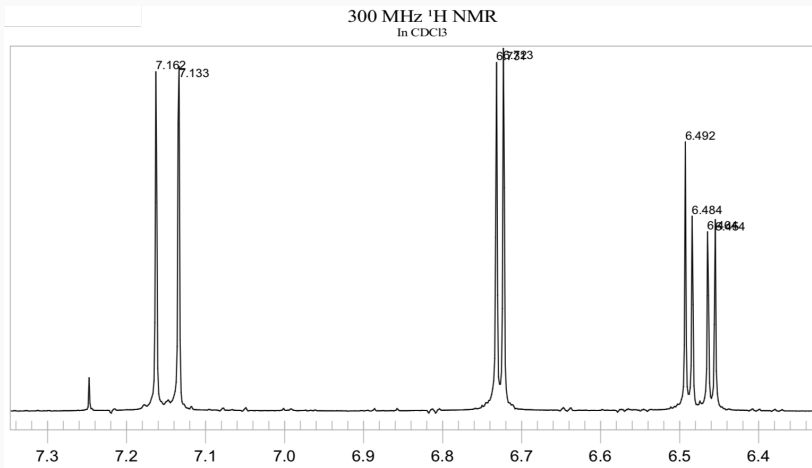
Exercício 4 - Espectro de ^{13}C



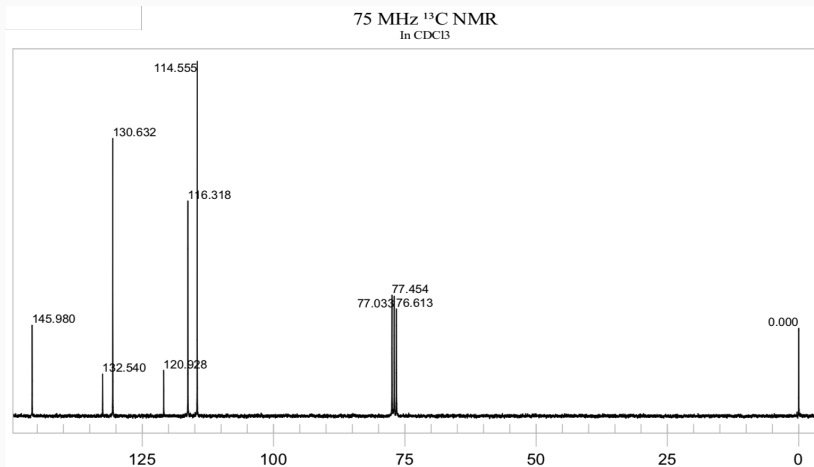
Exercício 5 - Espectro de ^1H



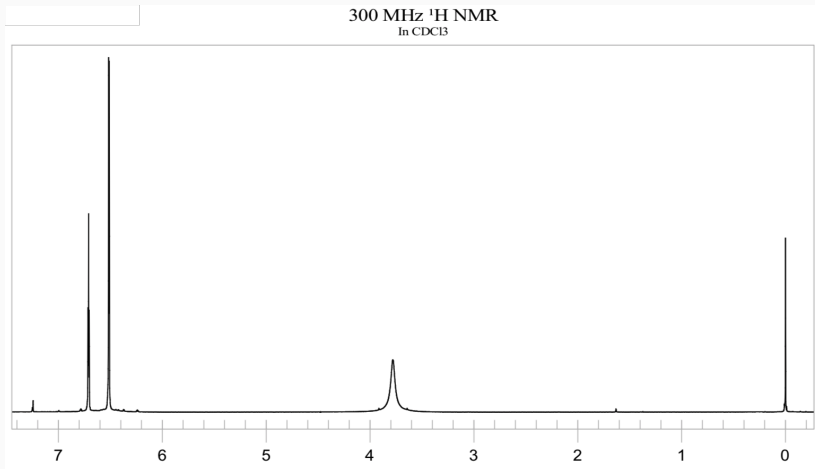
Exercício 5 - Espectro de ^1H : Expansão dos Sinais Aromáticos



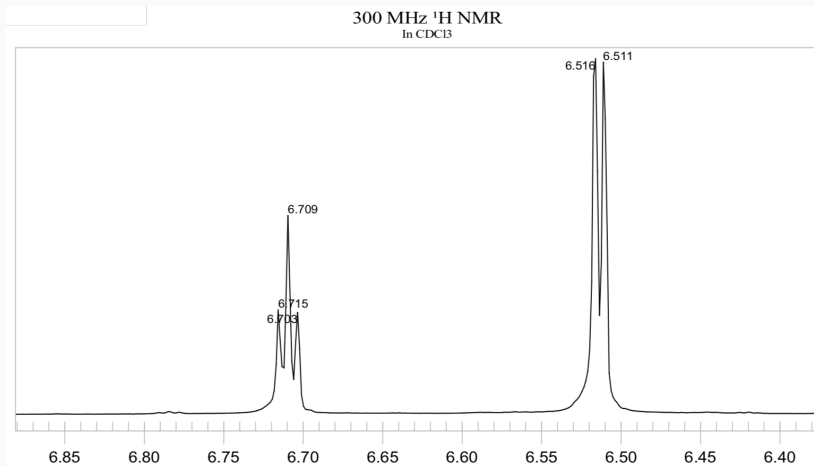
Exercício 5 - Espectro de ^{13}C



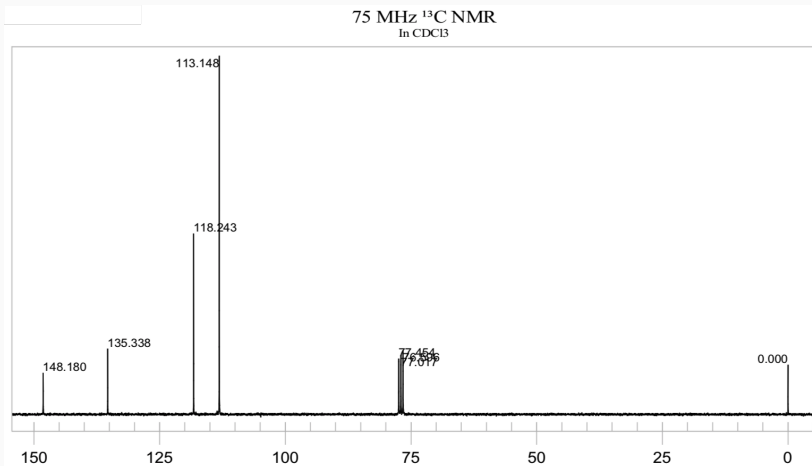
Exercício 6 - Espectro de ^1H



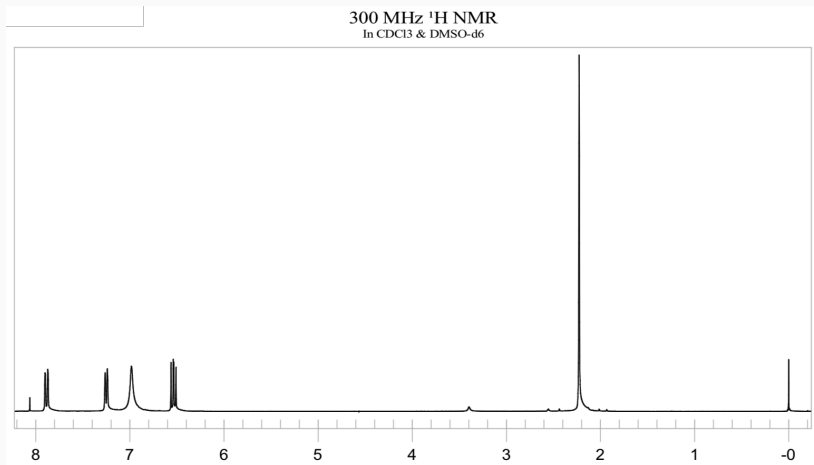
Exercício 6 - Espectro de ^1H : Expansão dos Sinais Aromáticos



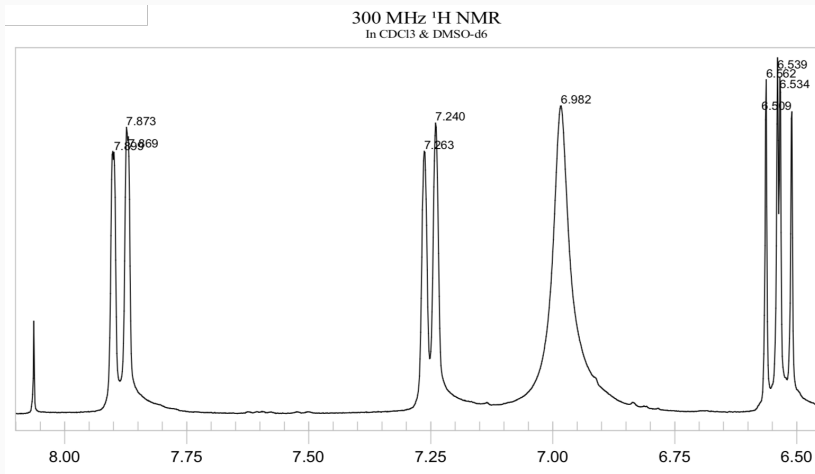
Exercício 6 - Espectro de ^{13}C



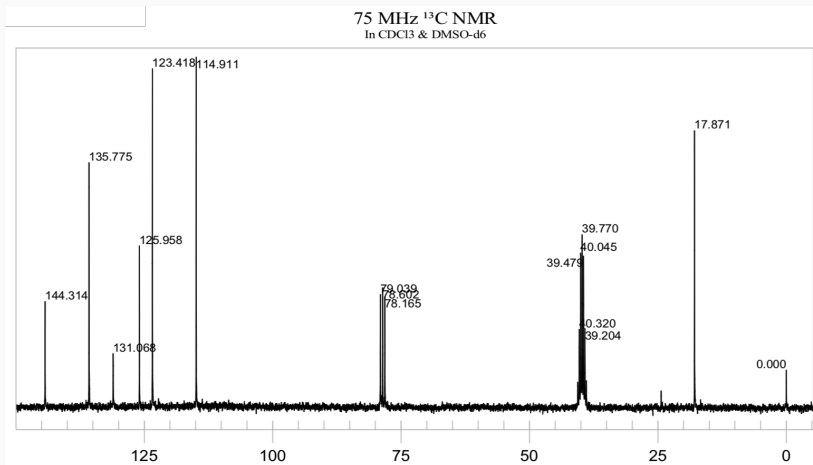
Espectro de ^1H da 2-Metil-6-nitroanilina



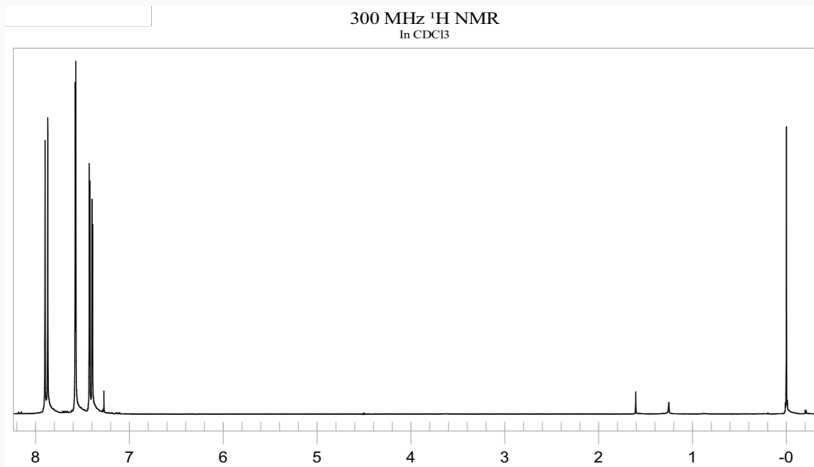
Espectro de ^1H da 2-Metil-6-nitroanilina



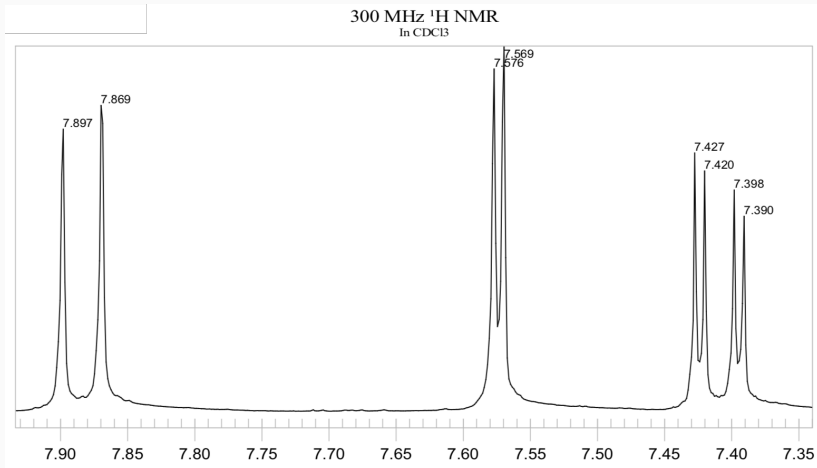
Espectro de ^{13}C da 2-Metil-6-nitroanilina



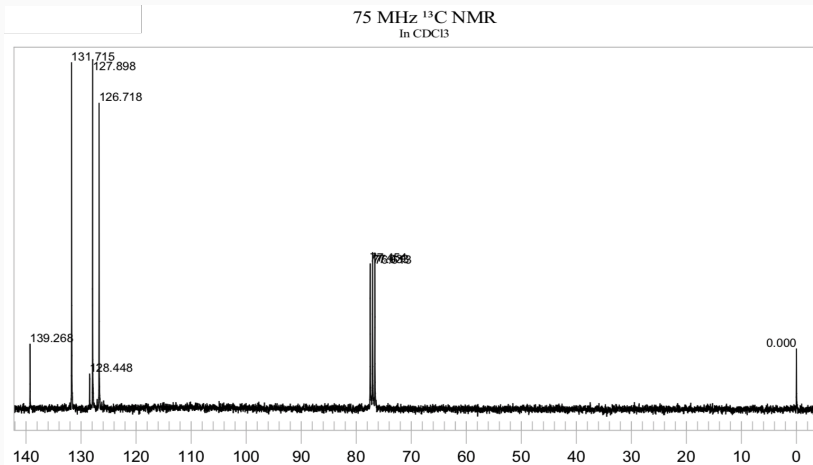
Espectro de ^1H do 2,4-Dicloro-nitrobenzeno



Espectro de ^1H do 2,4-Dicloro-nitrobenzeno

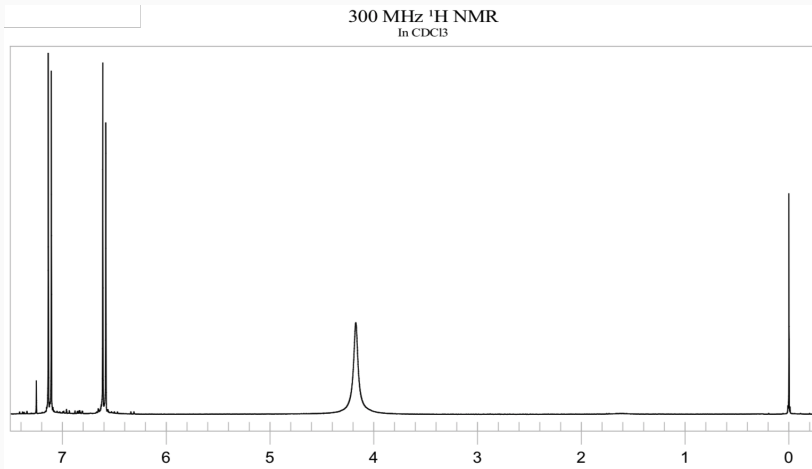


Espectro de ^{13}C do 2,4-Dicloro-nitrobenzeno

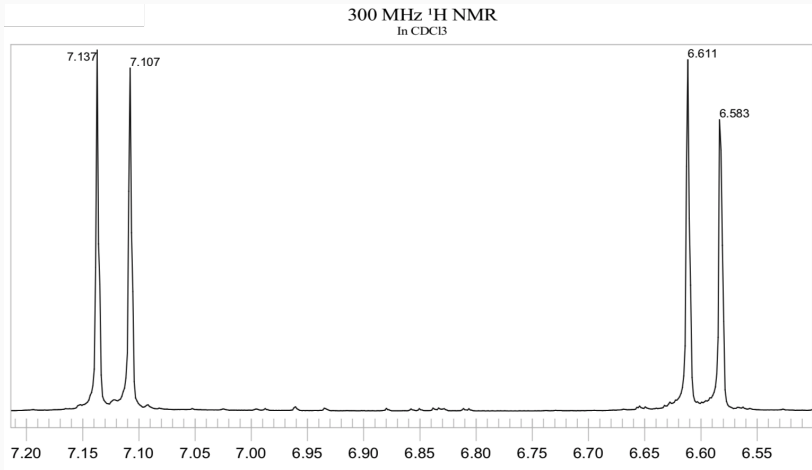


Exercícios - Espectros dos Isômeros da Tricloroanilina

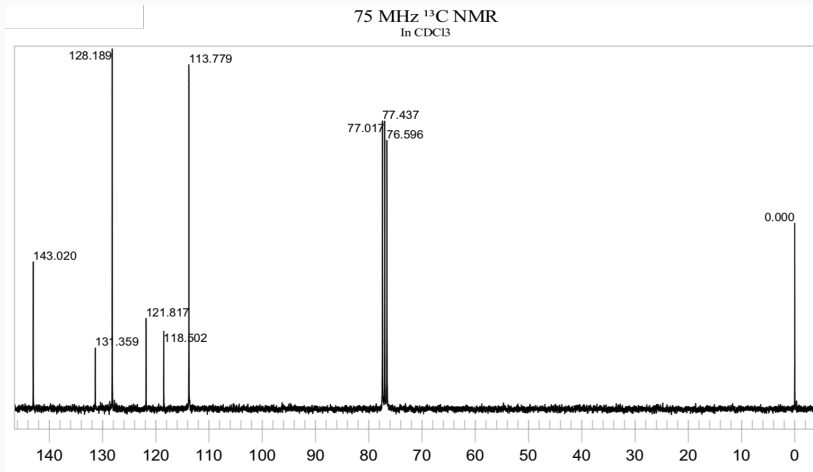
Exercício 7 - Espectro de ^1H



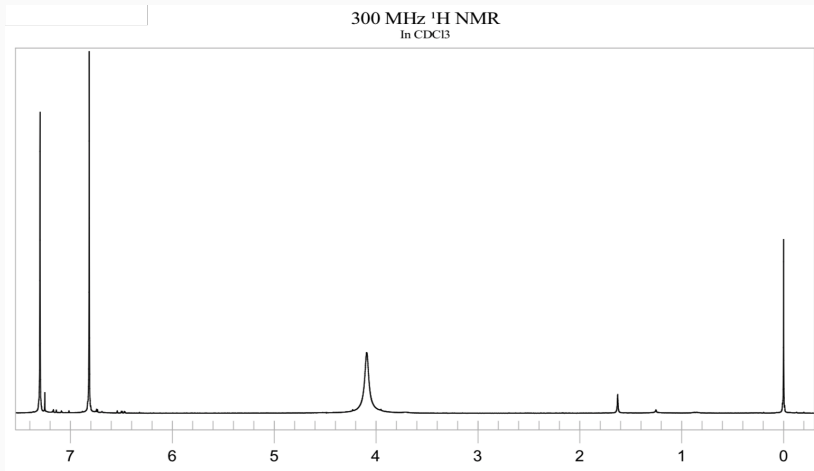
Exercício 7 - Espectro de ^1H : Expansão dos Sinais Aromáticos



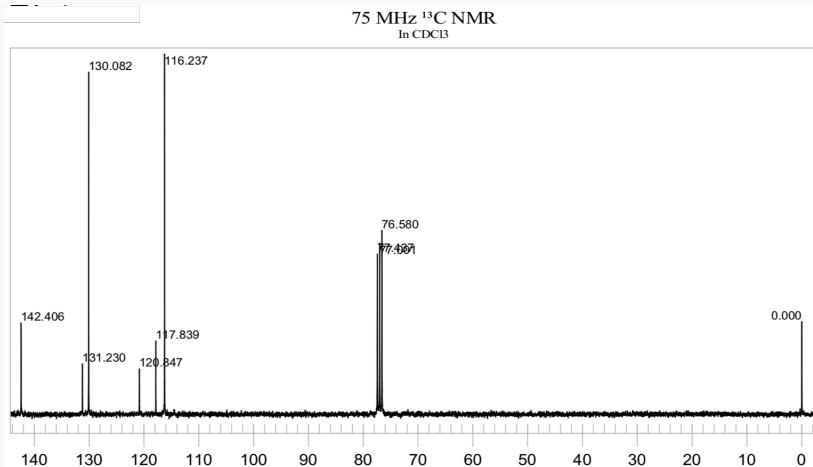
Exercício 7 - Espectro de ^{13}C



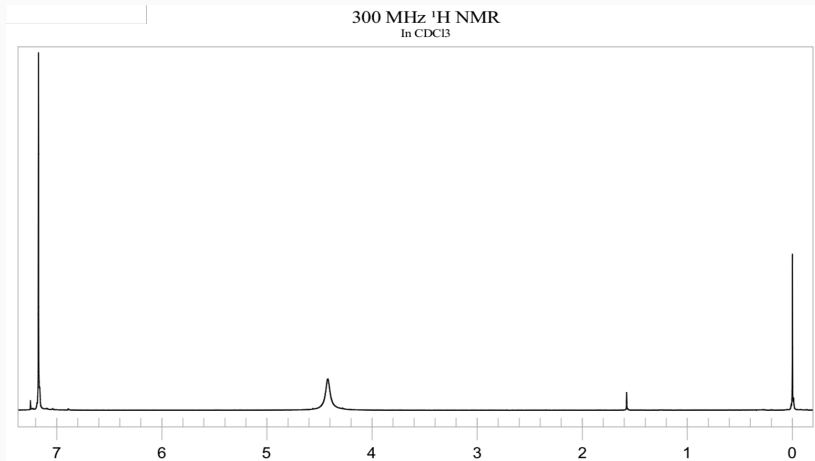
Exercício 8 - Espectro de ^1H



Exercício 8 - Espectro de ^{13}C



Exercício 9 - Espectro de ^1H



Exercício 9 - Espectro de ^{13}C

