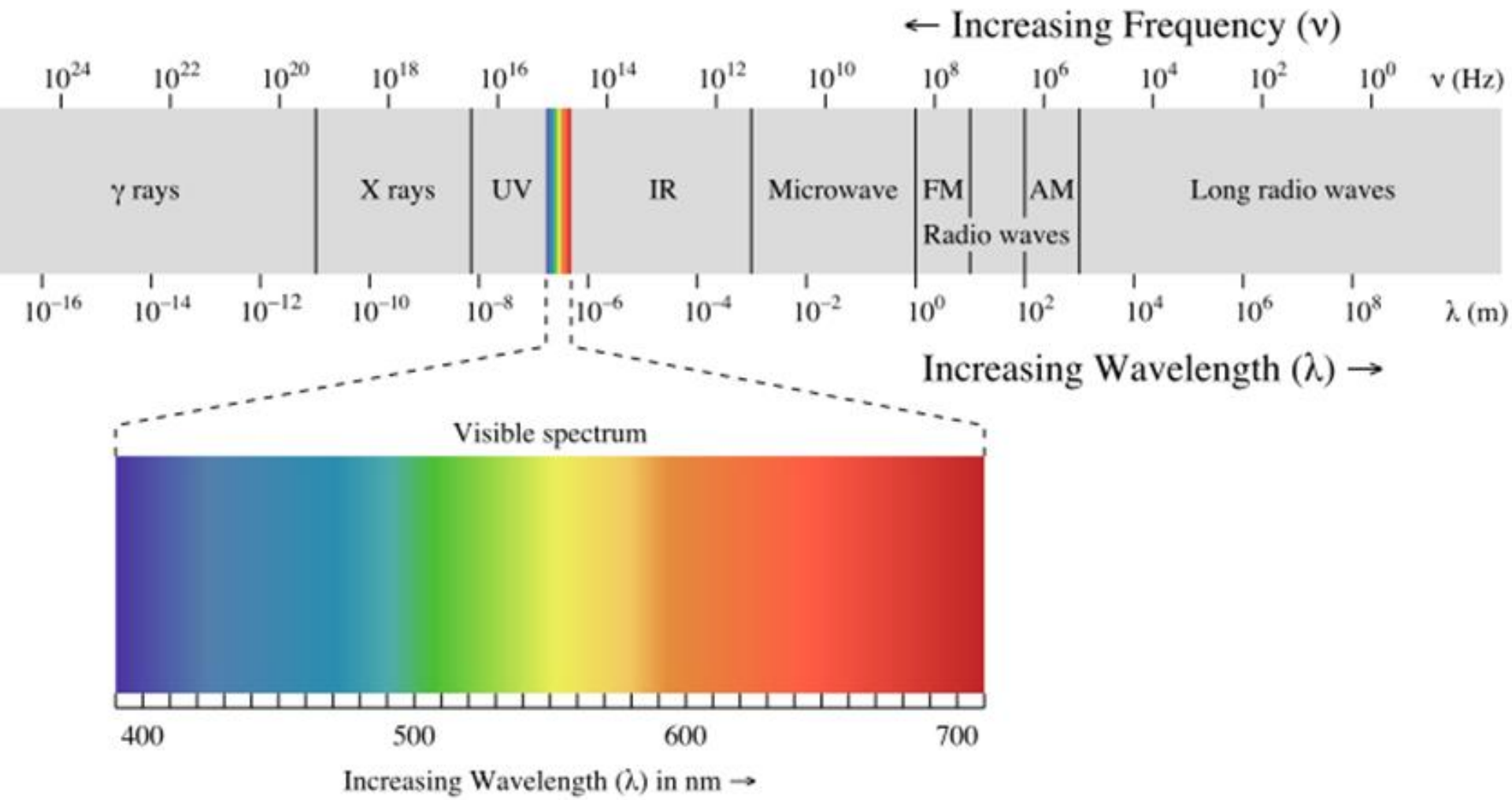
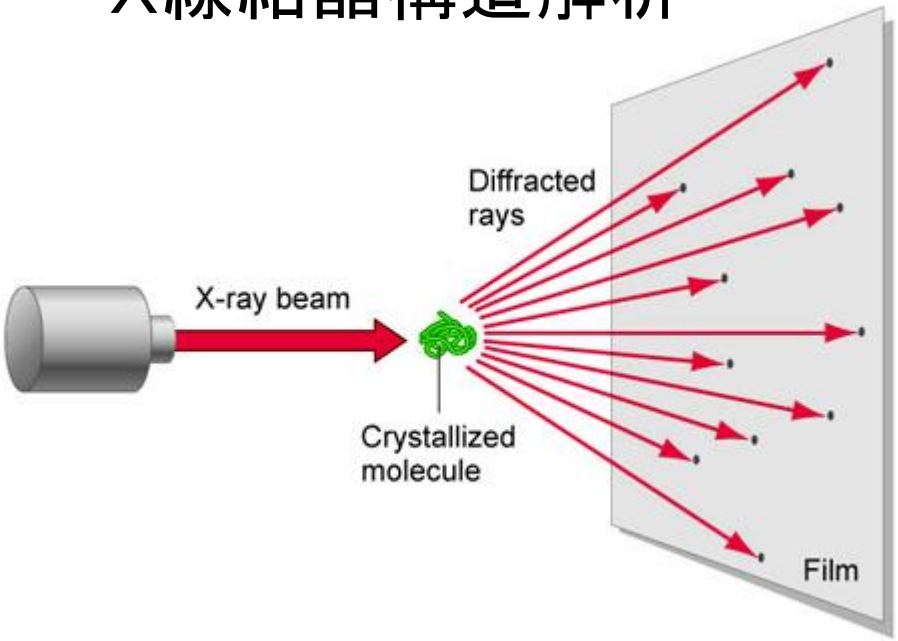
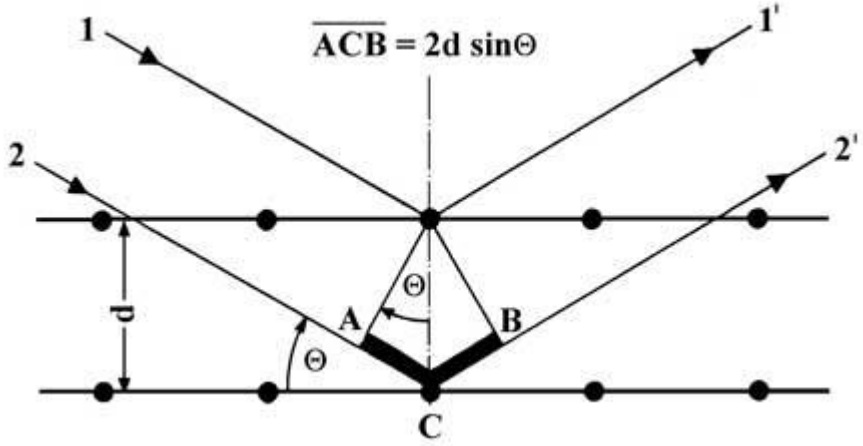
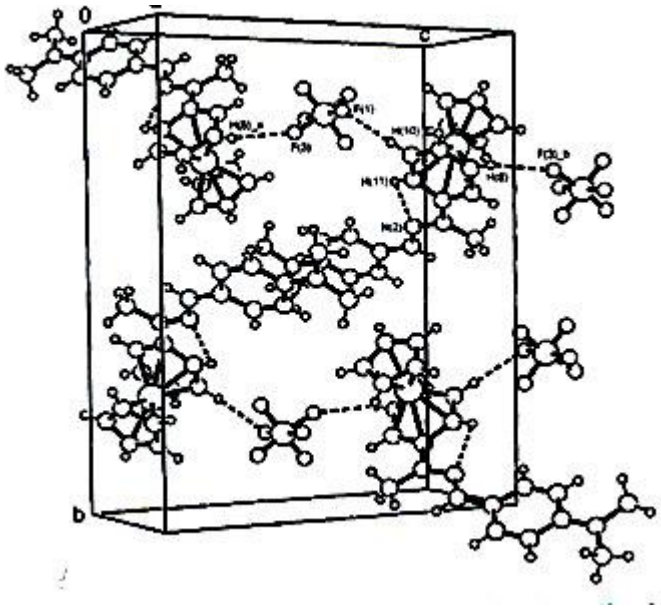
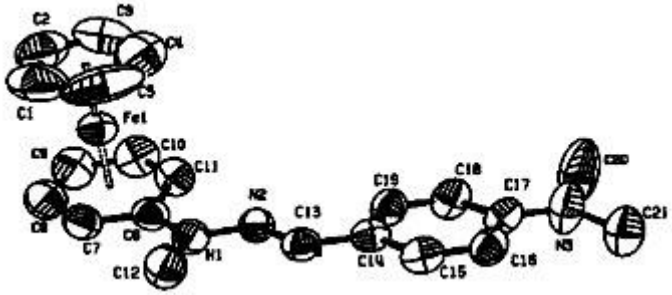

← Increasing Frequency (ν)
10^24 10^22 10^20 10^18 10^16 10^14 10^12 10^10 10^8 10^6 10^4 10^2 10^0 ν (Hz)
γ rays
X rays
UV
IR
Microwave
FM
AM
Radio waves
Long radio waves
10^-16 10^-14 10^-12 10^-10 10^-8 10^-6 10^-4 10^-2 10^0 10^2 10^4 10^6 10^8 λ (m)
Increasing Wavelength (λ) →
Visible spectrum
400
500
600
700
Increasing Wavelength (λ) in nm →

X線結晶構造解析

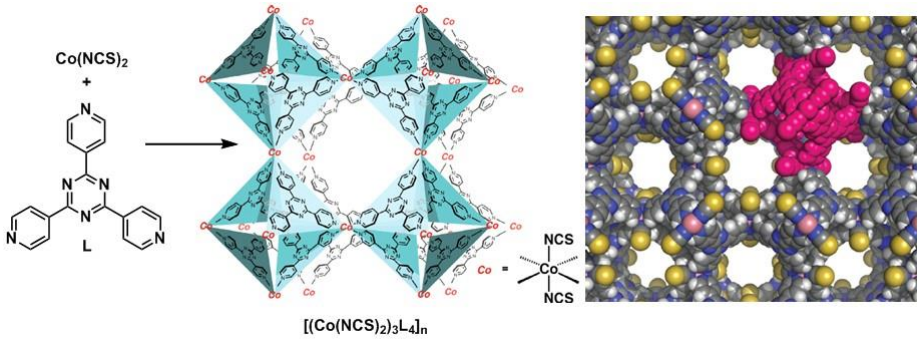

Diffracted
rays
X-ray beam
Crystallized
molecule
Film


1
1'
2
2'
$\overline{ACB} = 2d \sin\Theta$
d
Θ
Θ
A
B
C

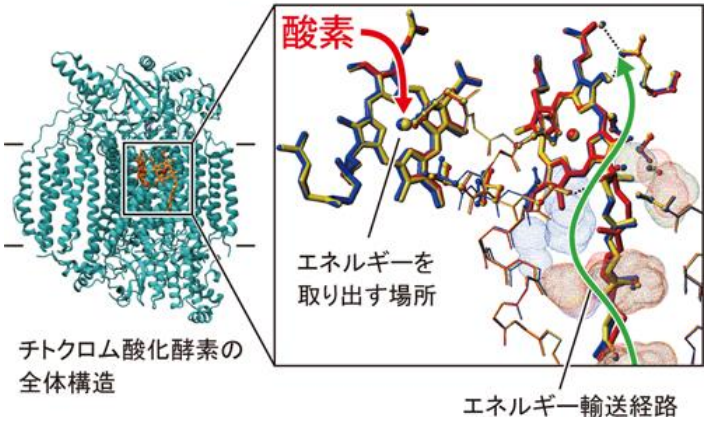


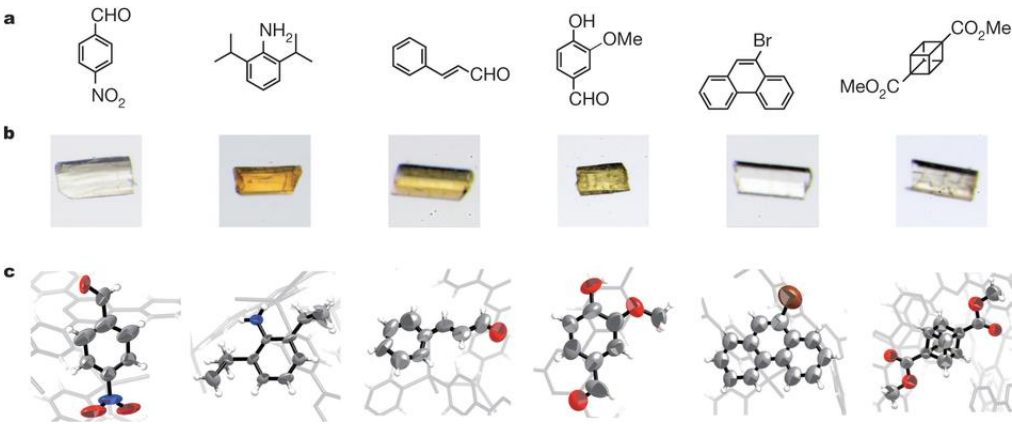


X線結晶構造解析ー最先端

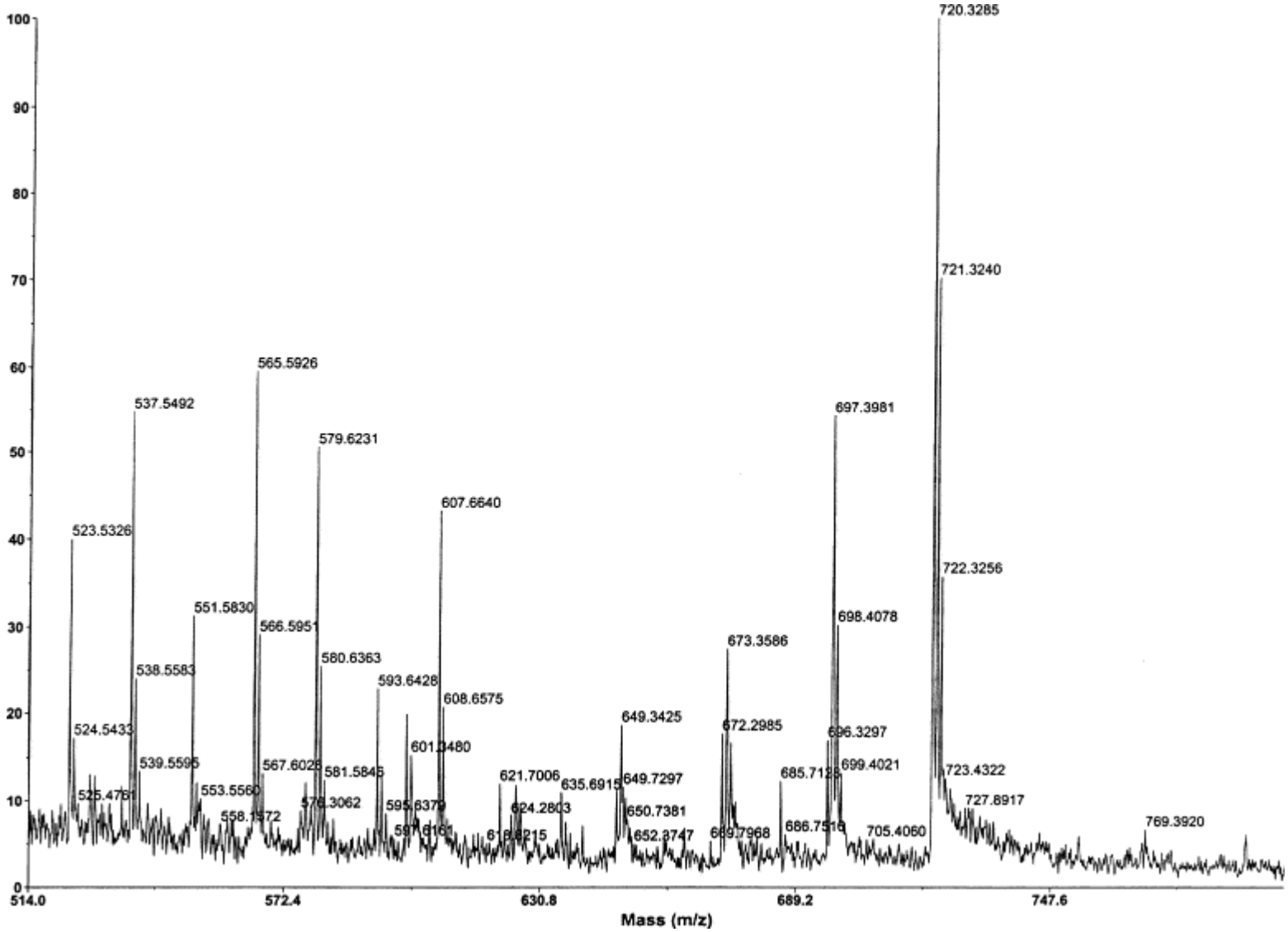


チトクロム酸化酵素がエネルギーを取り出すための構造

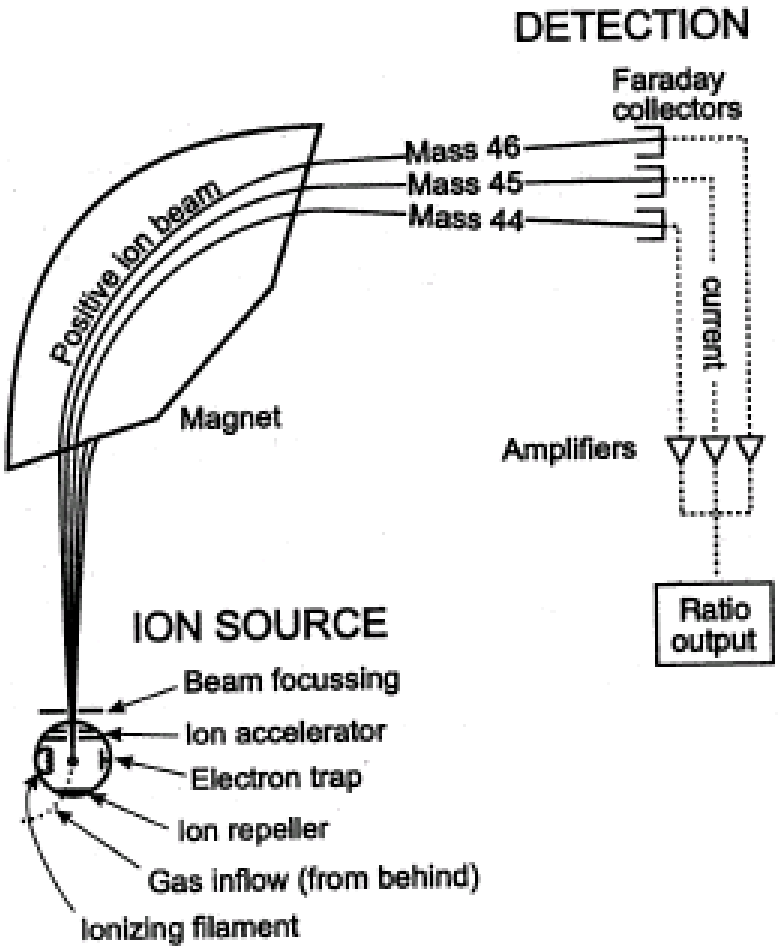




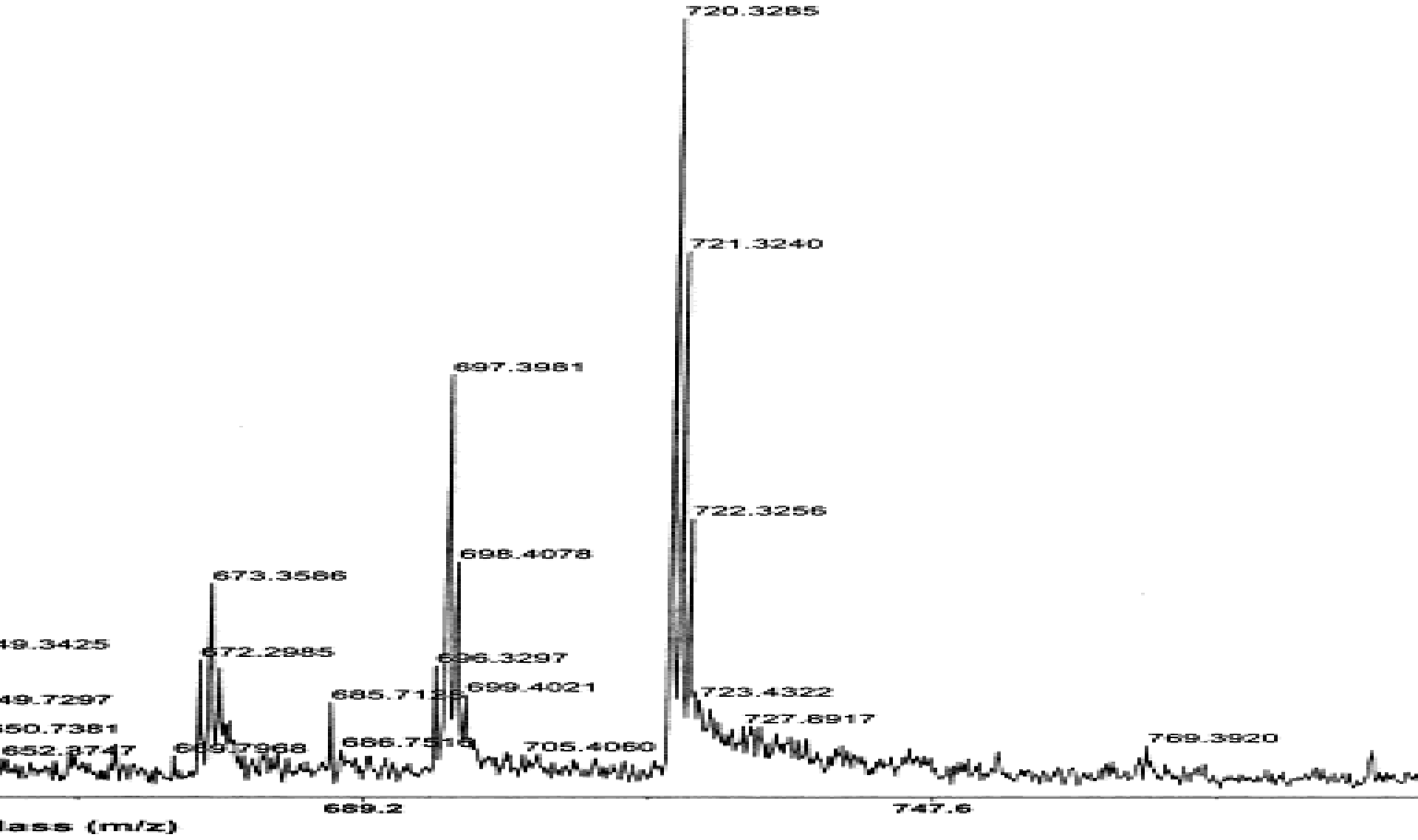
C_{60}のマススペクトル



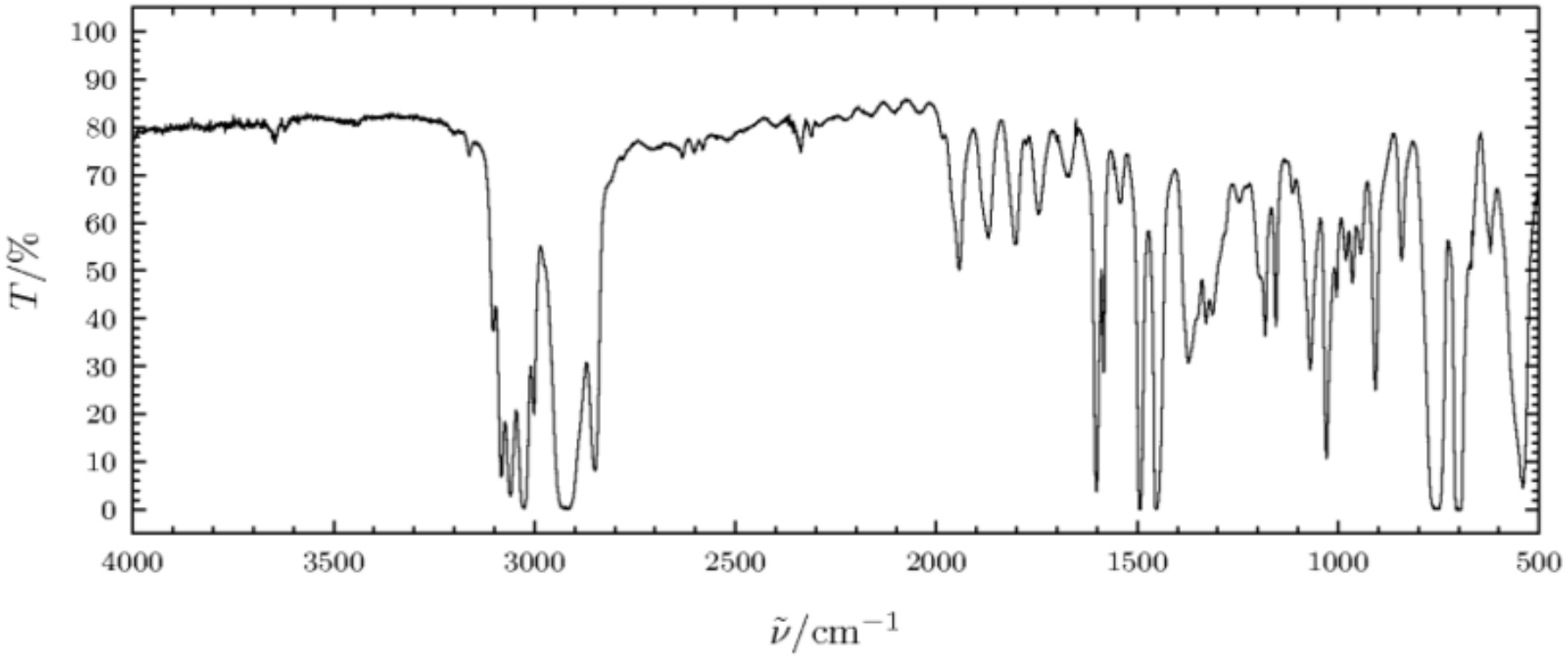
質量分析　Mass spectrum



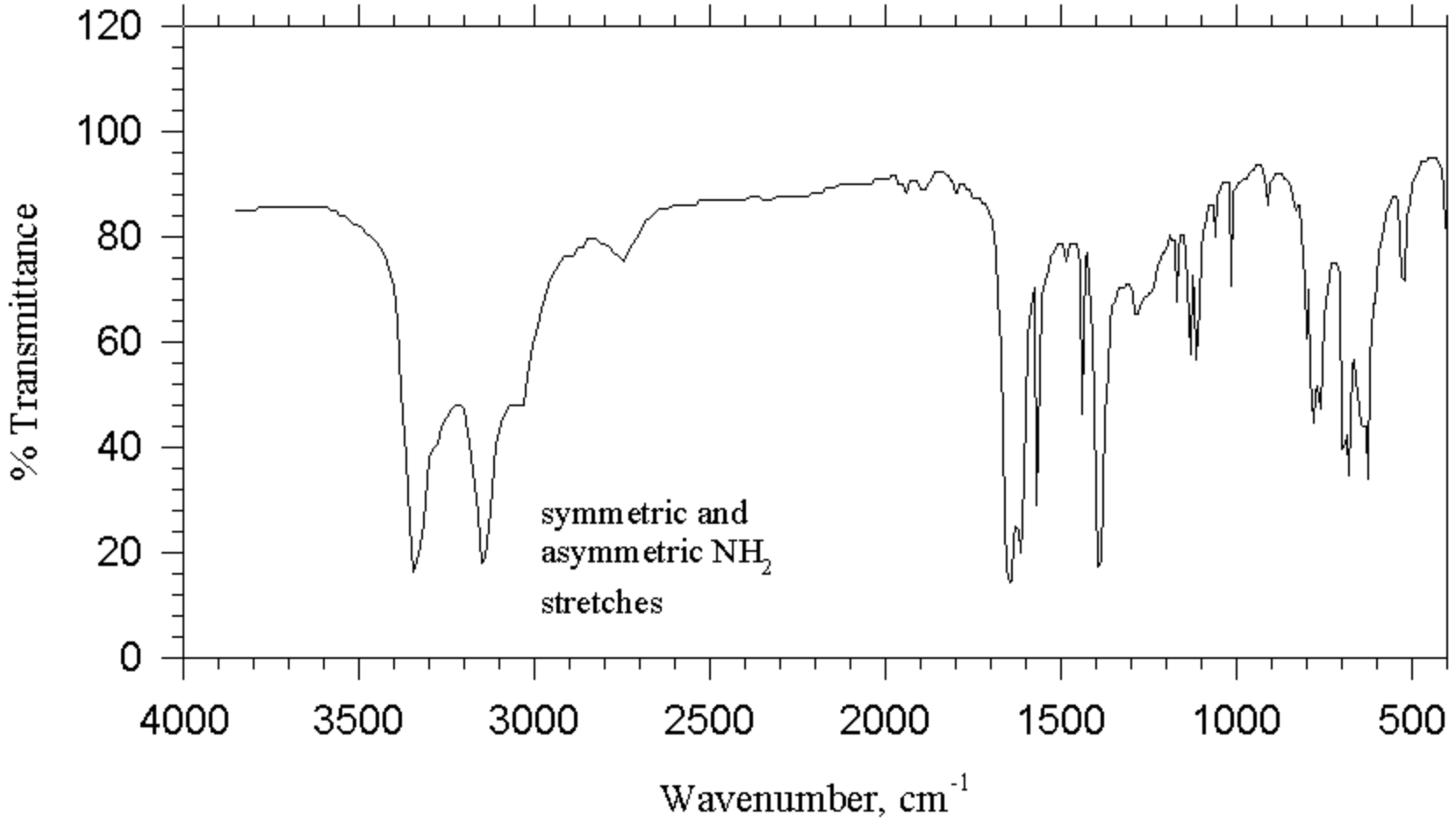
C_{60}のマススペクトル



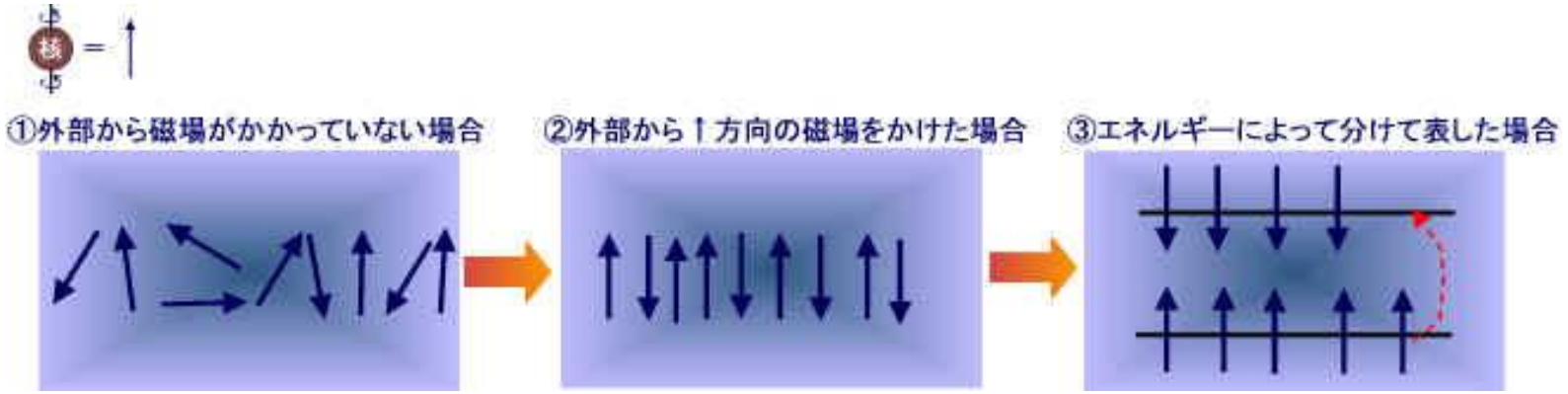
IRスペクトル


100
90
80
70
60
50
40
30
20
10
0
T/%
4000
3500
3000
2500
2000
1500
1000
500
$\tilde{\nu}/\mathrm{cm}^{-1}$

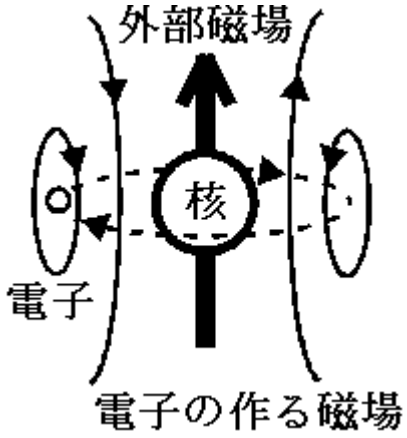
ベンズアミドのIRスペクトル



NMRスペクトル



それぞれの核が“感じる”磁場の大きさは周囲の電子の影響を受ける

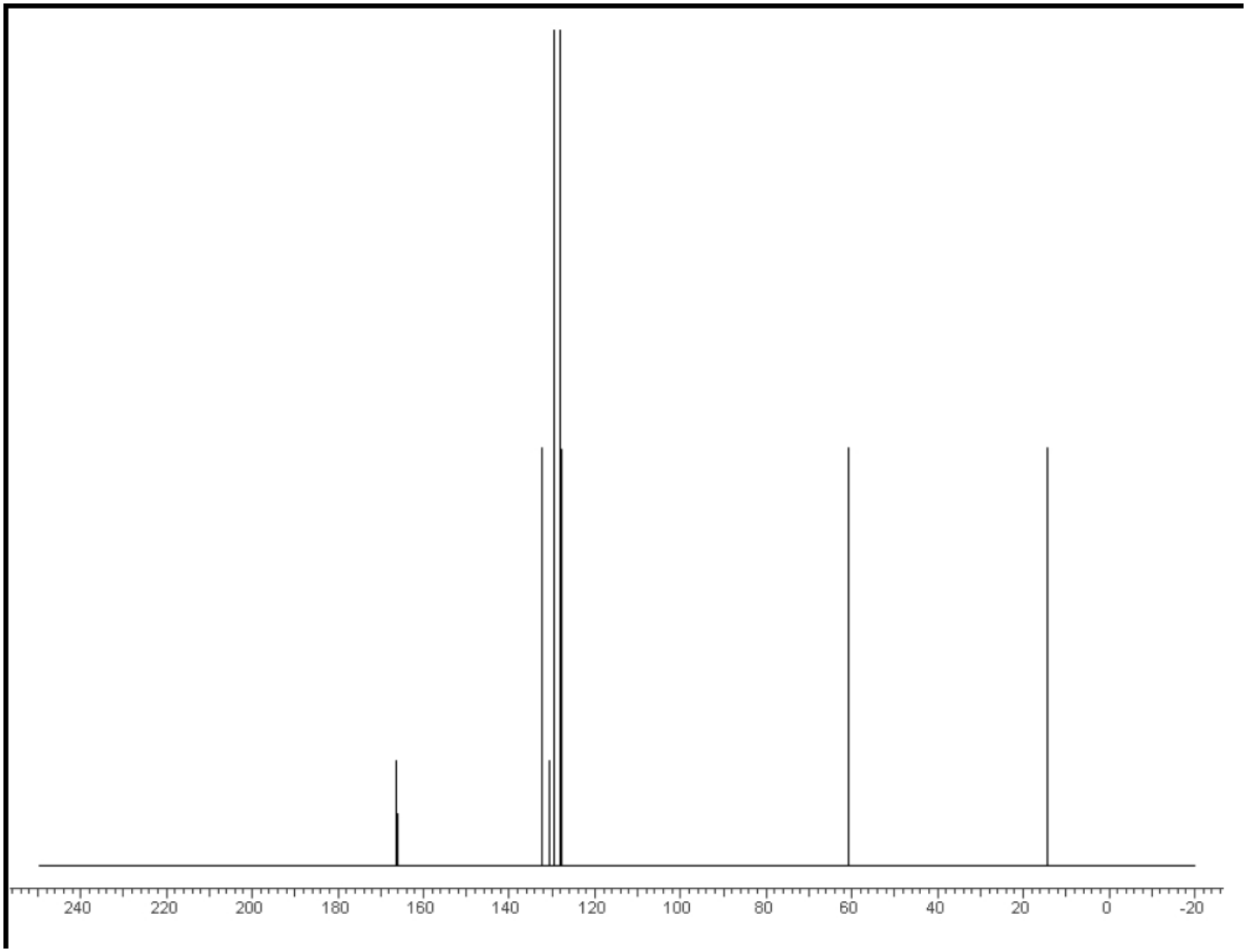


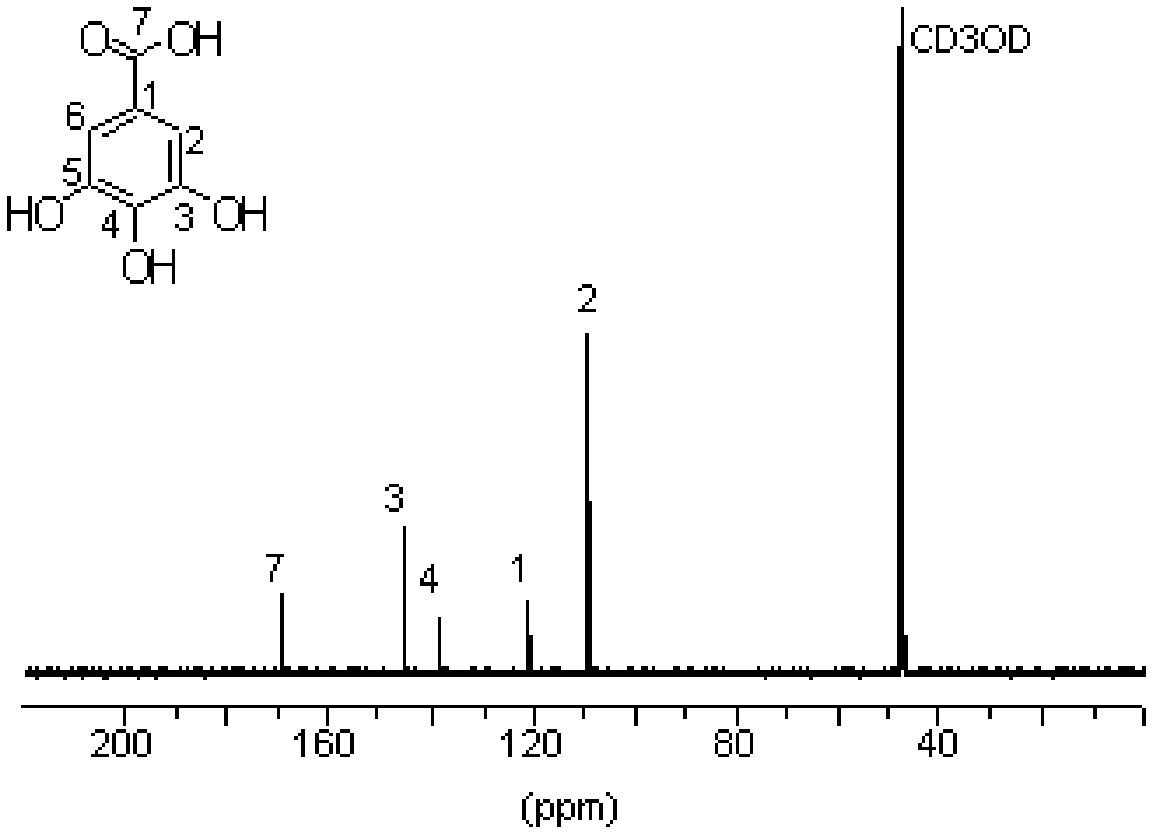
NMRスペクトル

観測可能なのは核スピンが0でない核

質量数	原子番号	核スピンI	核種の例
奇数	奇数、偶数	半整数（1/2, 2/3, 2/5, …）	^{1}H, ^{15}N, ^{13}C, ^{17}O, ^{19}F, ^{31}P, ^{129}Xe, …
偶数	偶数	0	^{12}C, ^{16}O, ^{32}S, …
偶数	奇数	整数（1、2、3、…）	^{2}D, ^{14}N, …

安息香酸エチルの^{13}C NMRスペクトル





*** Current Data Parameters ***

NAME: piccgrape2

EXPNO : 5

PROCNO: 1

*** Acquisition Parameters ***

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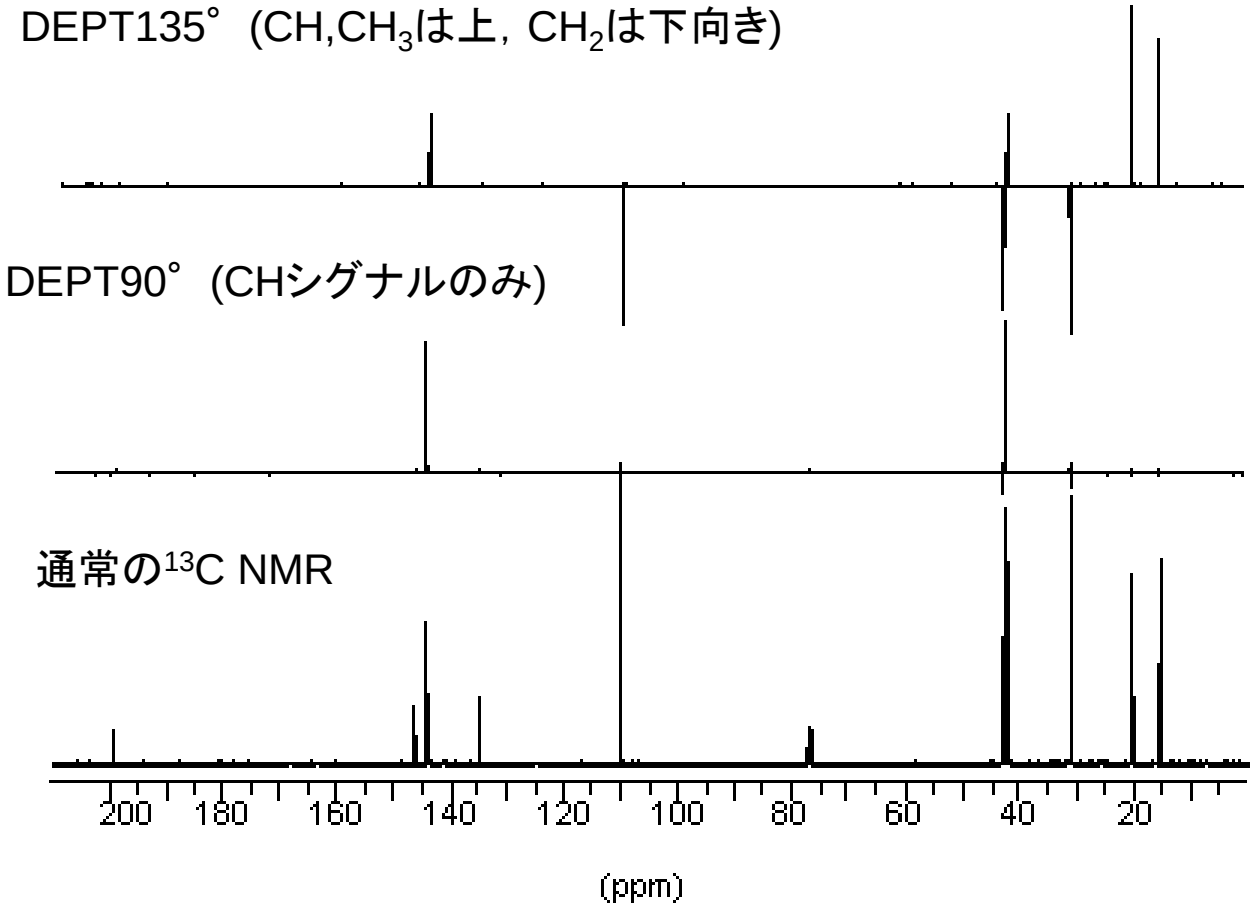
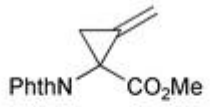
DATE_t :	11:38:35
DATE_d :	Nov 12 1998
DS :	2
NS :	128
O1 :	13766.91 Hz
PROBHD :	5 mm Dual 1999/1/28-
PULPROG :	zgpg30.loop
SW_h :	33333.333 Hz
TD :	65536
TE :	298.0K

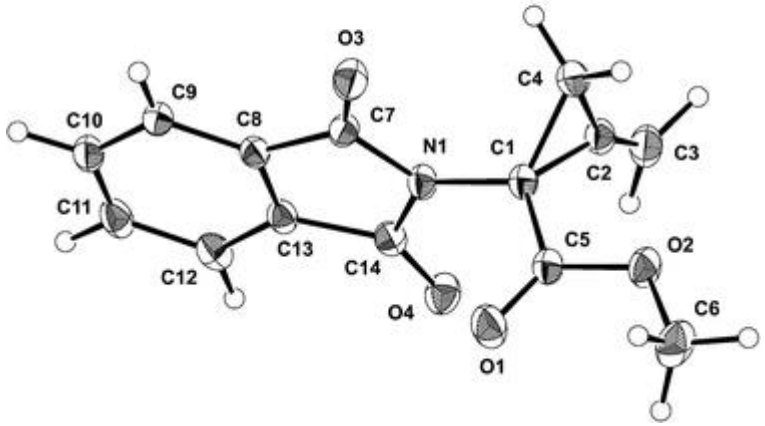
カルボンの^{13}C NMR (DEPT) スペクトル

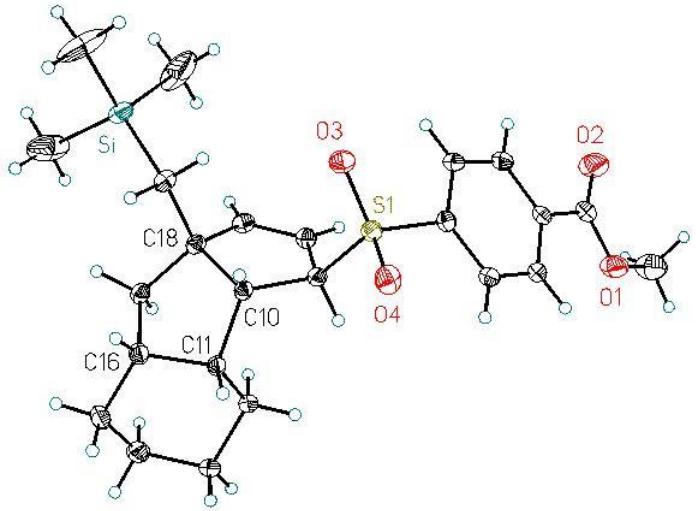


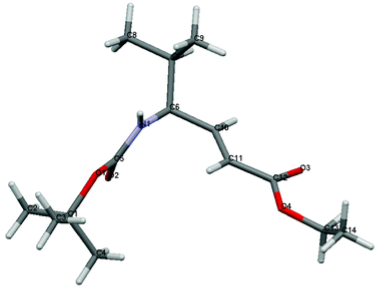
*** Current Data Parameters ***
NAME picccarv
EXPNO 4
PROCNO 1
*** Acquisition Parameters ***
BF1 : 125.7577
D[1] : 2.0000
DATE_t 10:42:30
DATE_d Apr 06 1998
DL[0] : dB 10.00
DS : 2
HL1 : dB 90
L[1] : 1000
NS : 32
O1 : 13766.9
P[1] : usec 7.4
P[3] : 16.0
PROBHD 5 mm Dual 13C/1H
PULPROG zgpg30
SW_h 33333.3
TD : 65536
TE : 298.0


PhthN
CO2Me

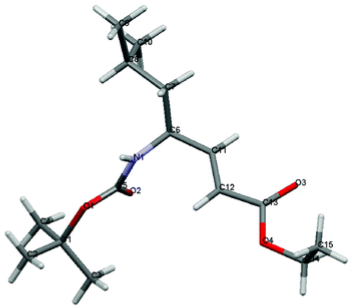
33


O3
C9
C10
C8
C7
C4
N1
C1
C2
C3
C11
C13
C14
C5
O2
C12
O4
C6
O1

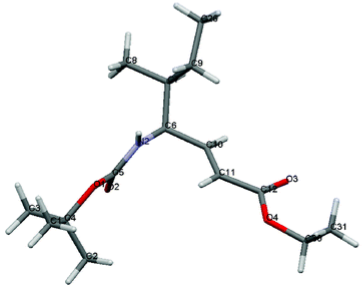

Si
O3
S1
O2
C18
C10
O4
O1
C16
C11



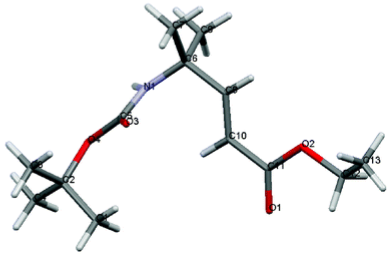
2C



4C

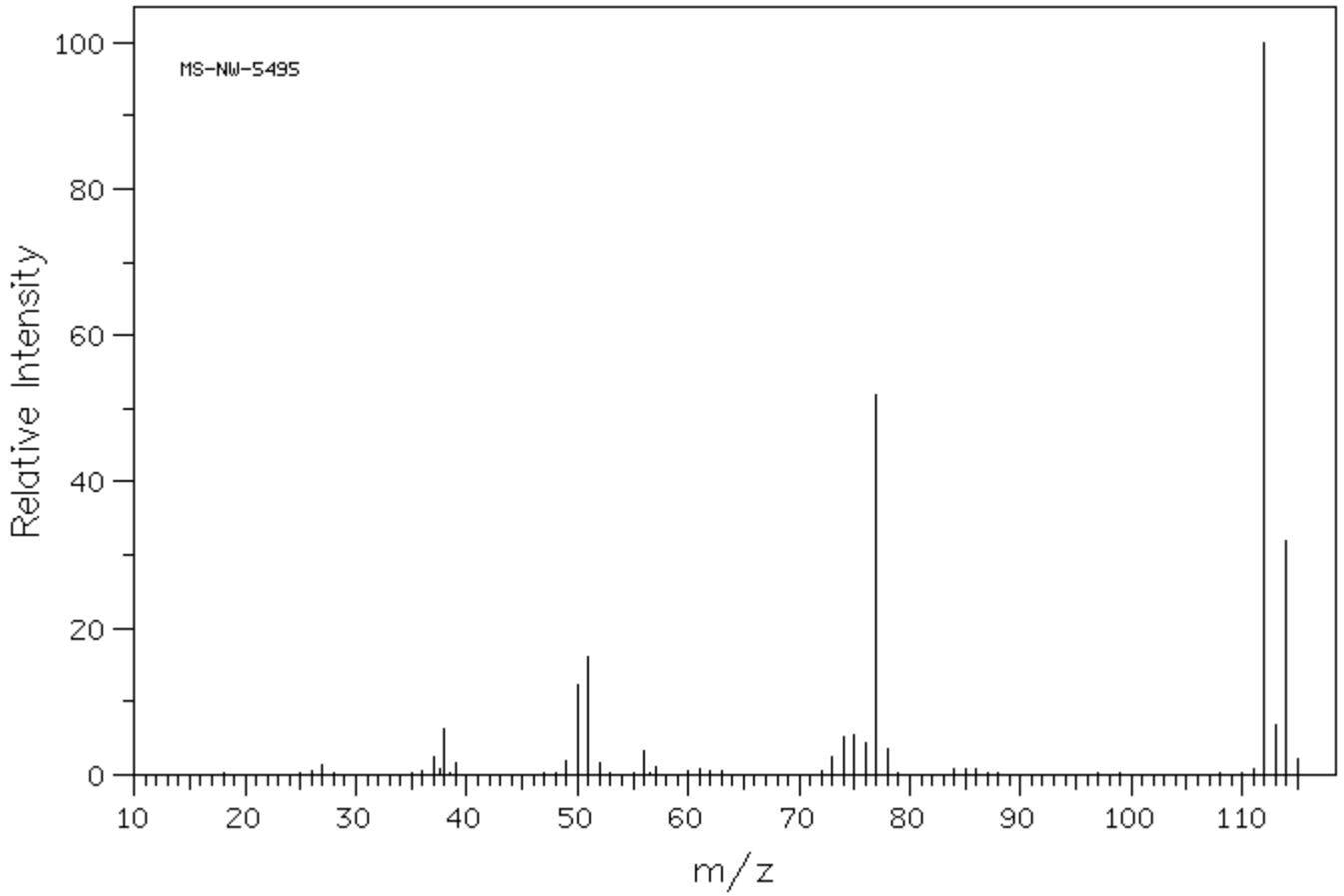


5C

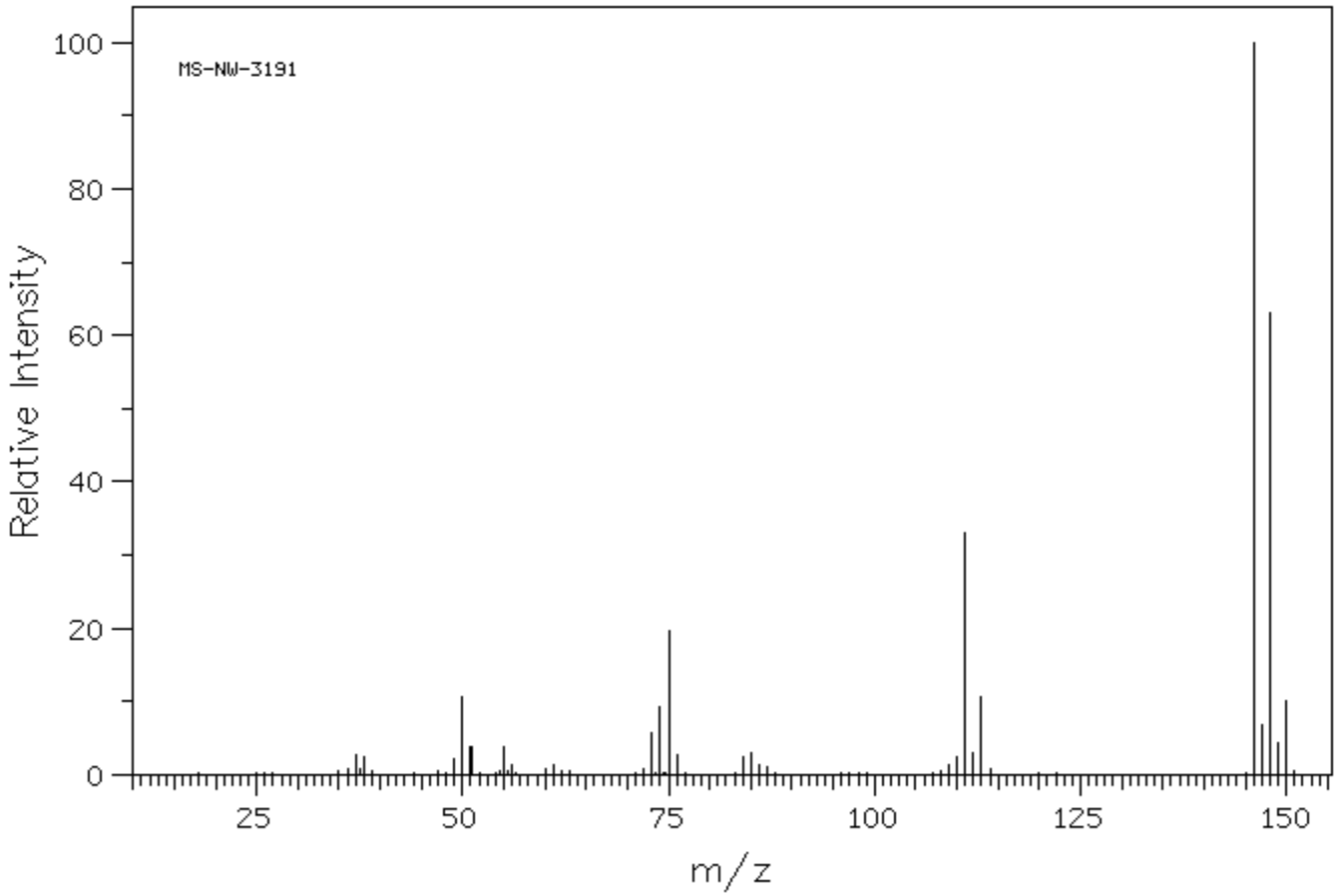


6C

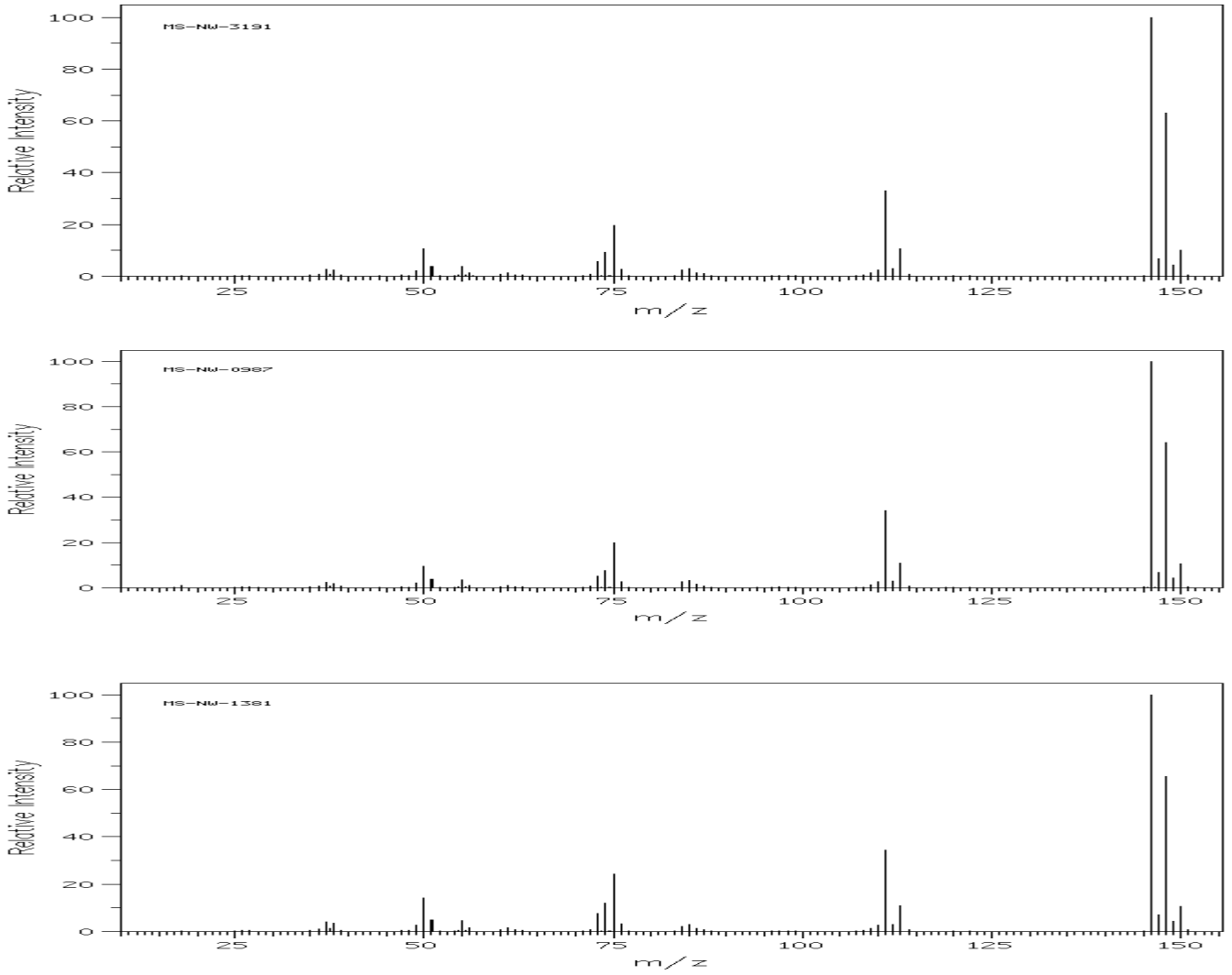
PhCl


MS-NW-5495
Relative Intensity
100
80
60
40
20
0
10
20
30
40
50
60
70
80
90
100
110
m/z

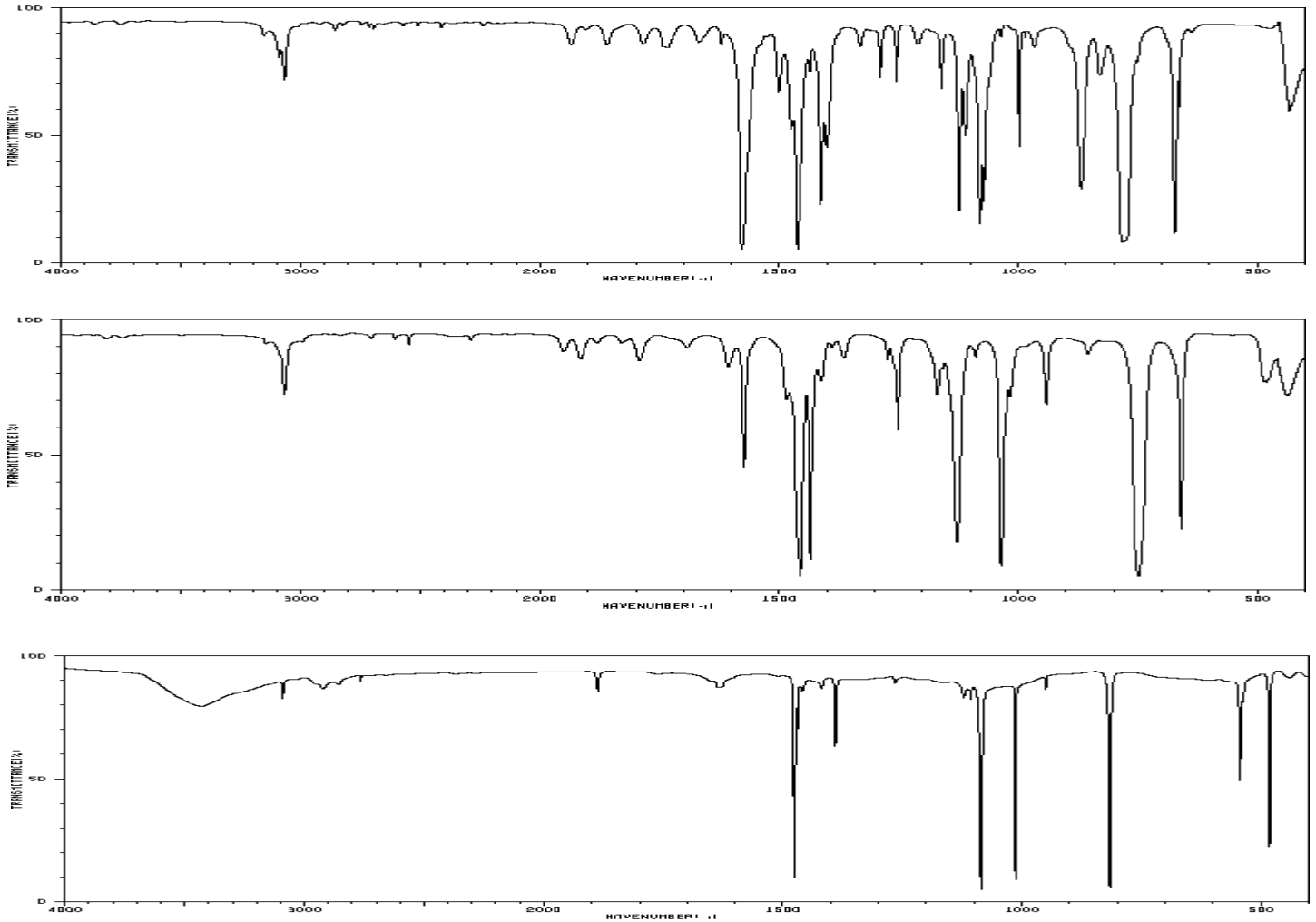
o-$C_6H_4Cl_2$


MS-NW-3191
Relative Intensity
100
80
60
40
20
0
25
50
75
100
125
150
m/z

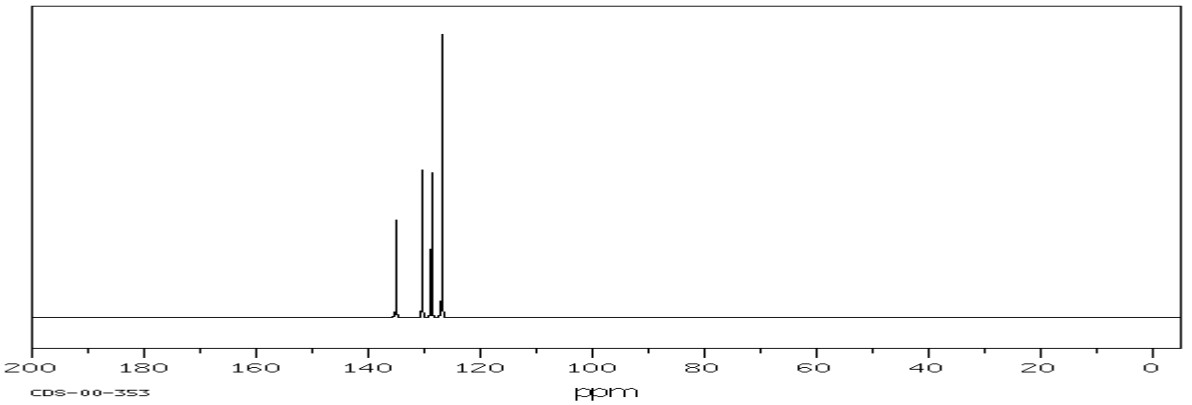
$C_6H_4Cl_2$の各異性体。どれが何？

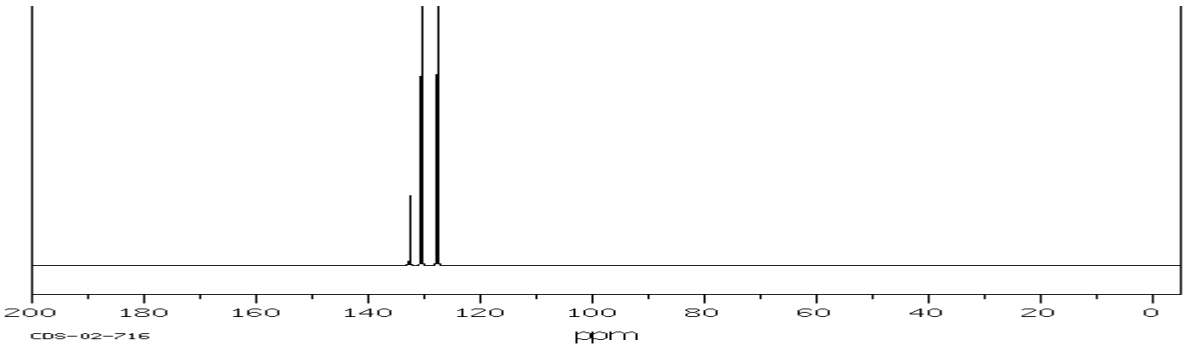


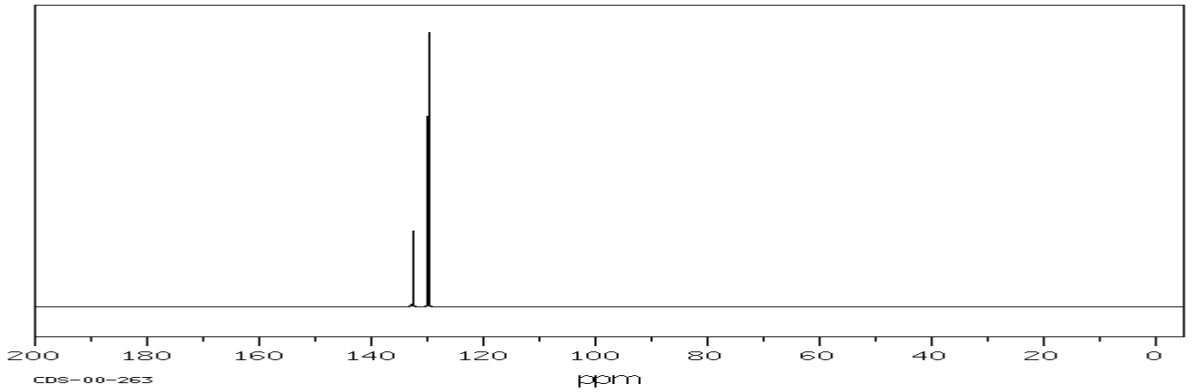
$C_6H_4Cl_2$の各異性体。どれが何？



$C_6H_4Cl_2$どれが何？

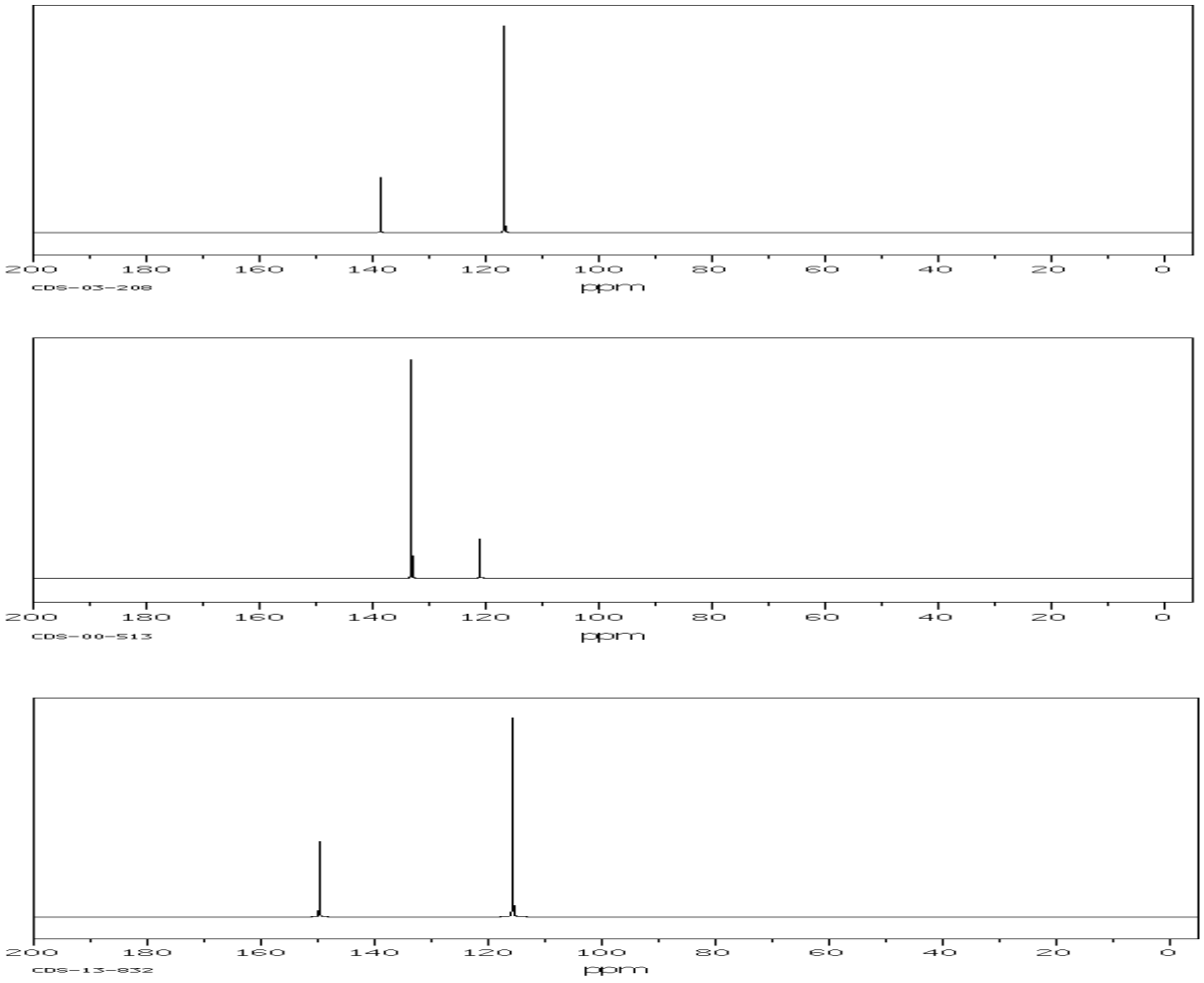






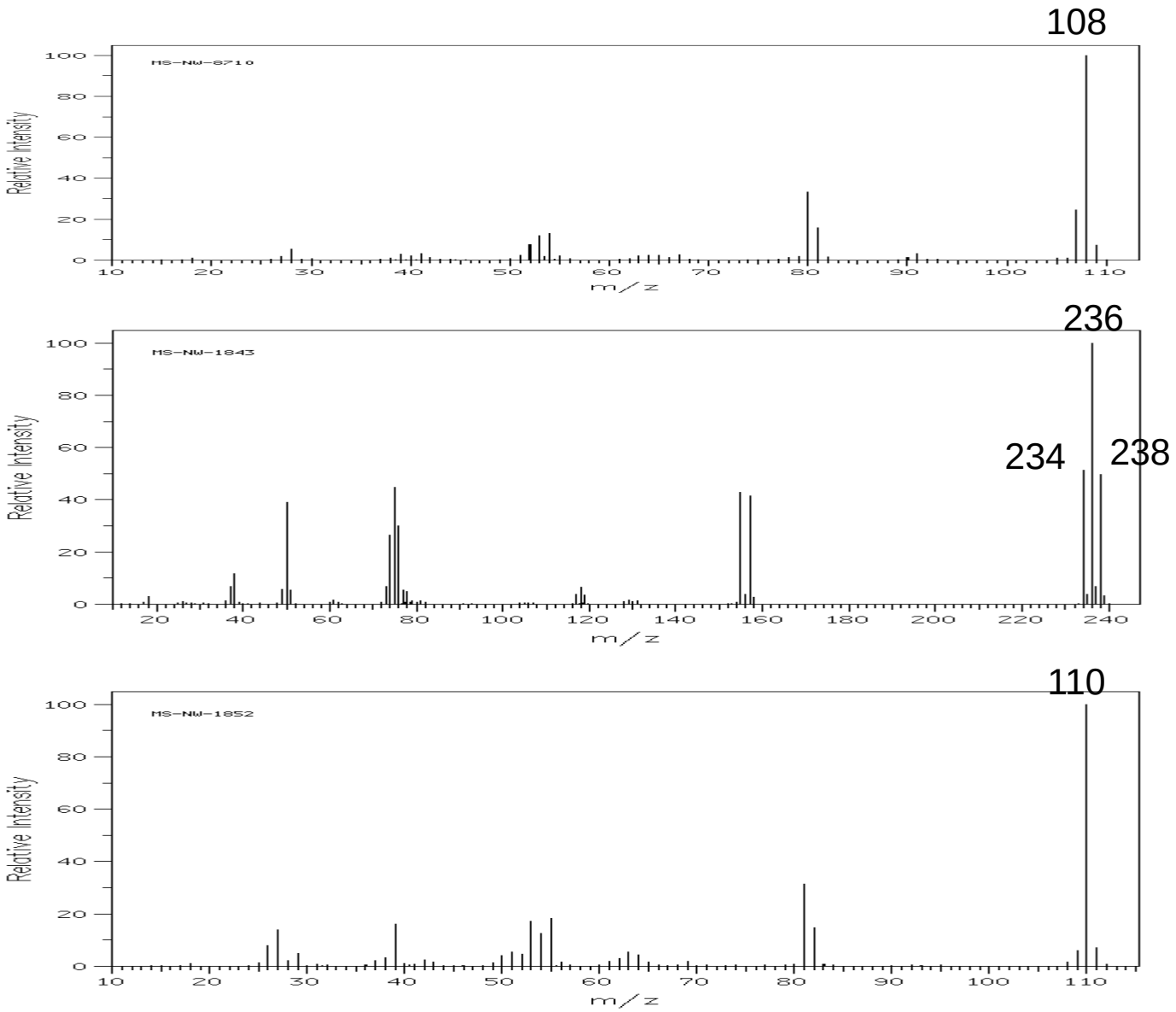
200 100 0

p-$C_6H_4X_2$（X=OH, Br, NH_2）どれがどれ？^{13}C NMR

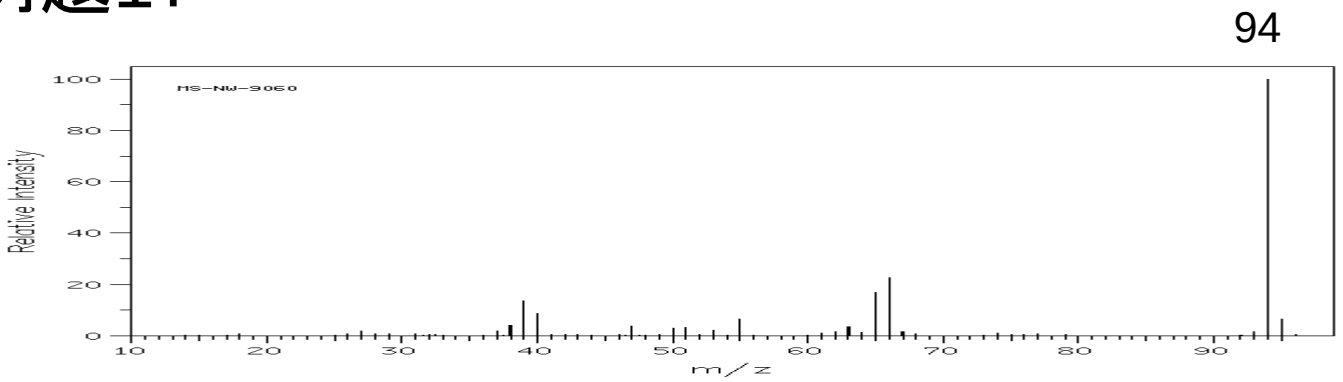


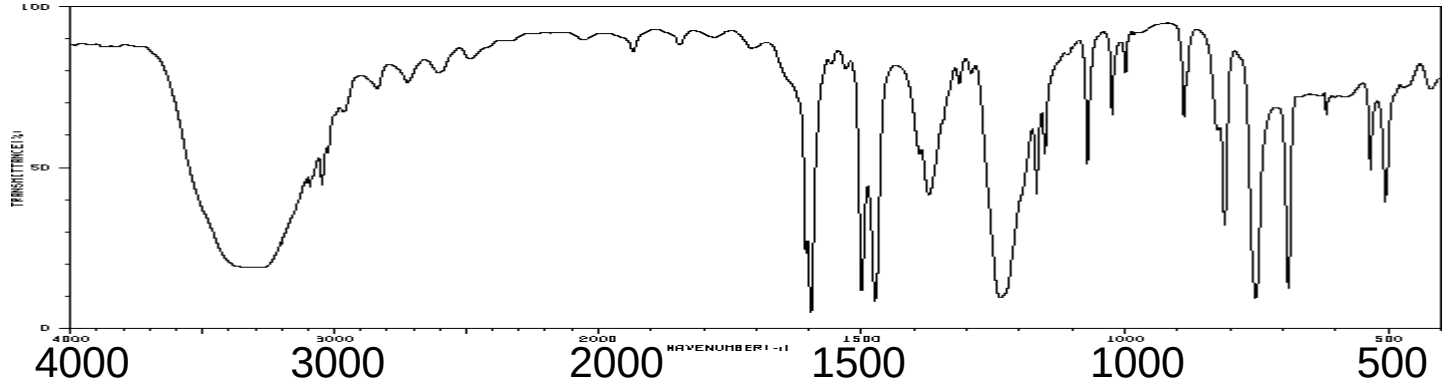
200 100 0

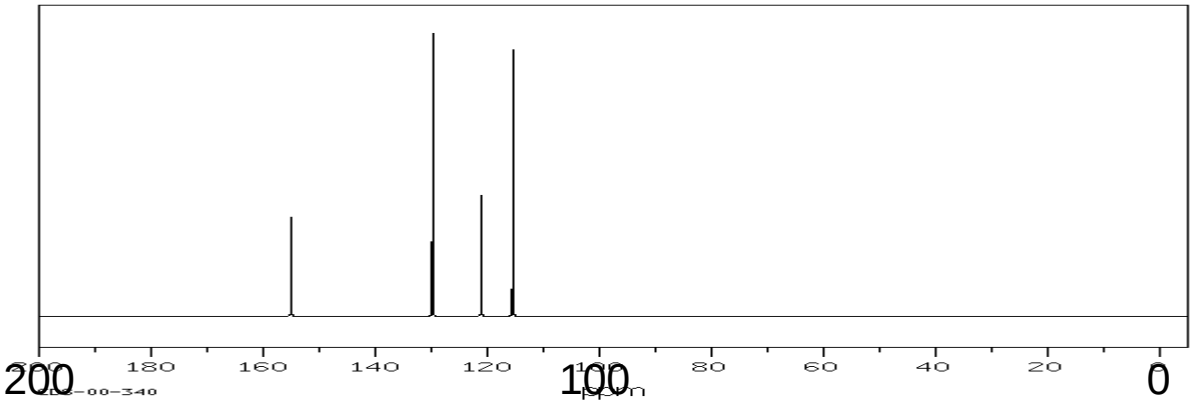
p-$C_6H_4X_2$（X=OH, NH_2, Br）どれがどれ？



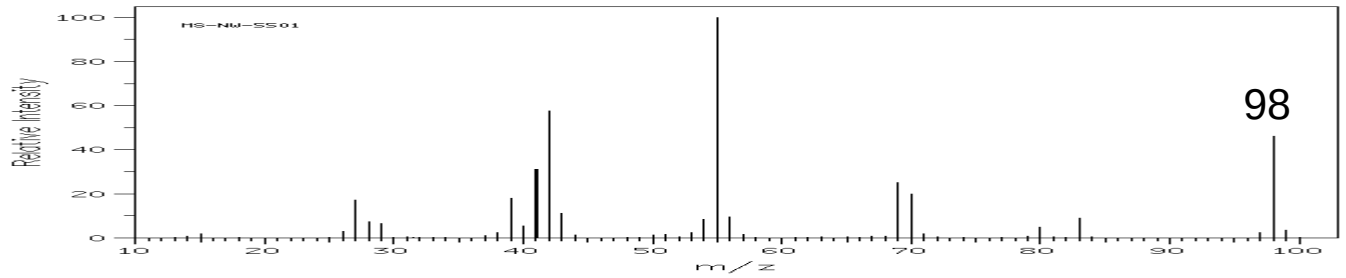
例題1:

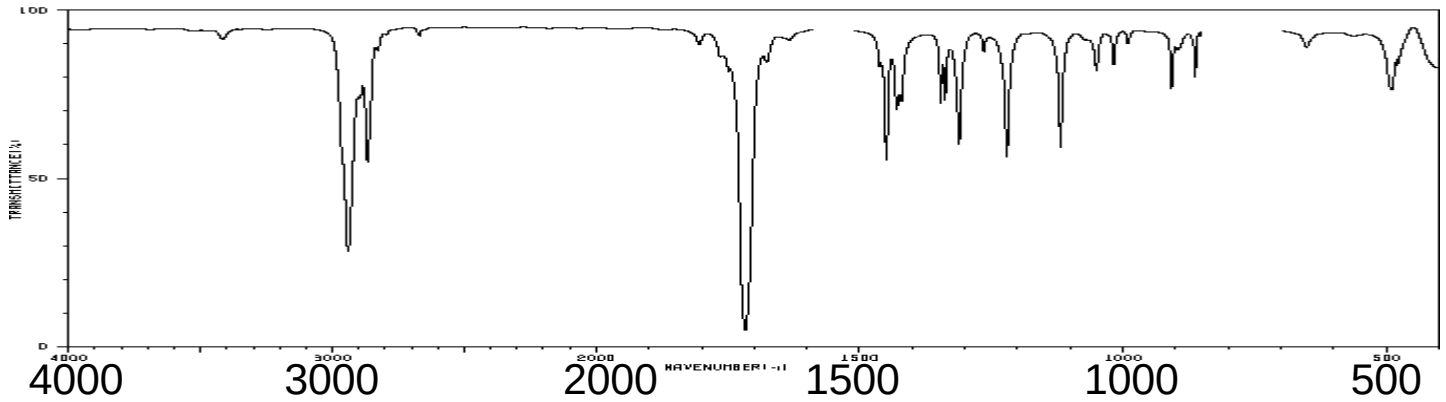

94
MS-NW-3060
Relative Intensity
100
80
60
40
20
0
10
20
30
40
50
60
70
80
90
m/z

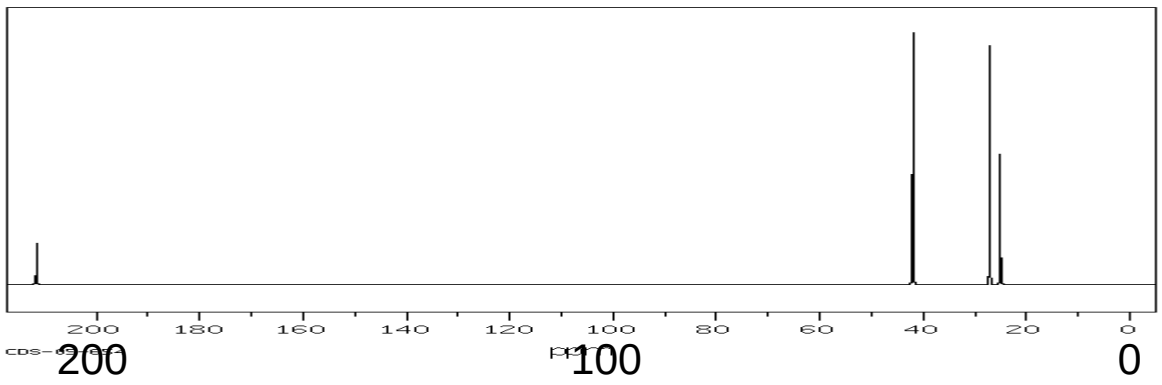

100
50
0
4000
3000
2000
1500
1000
500
WAVENUMBER(-1)


200
180
160
140
120
100
80
60
40
20
0
ppm

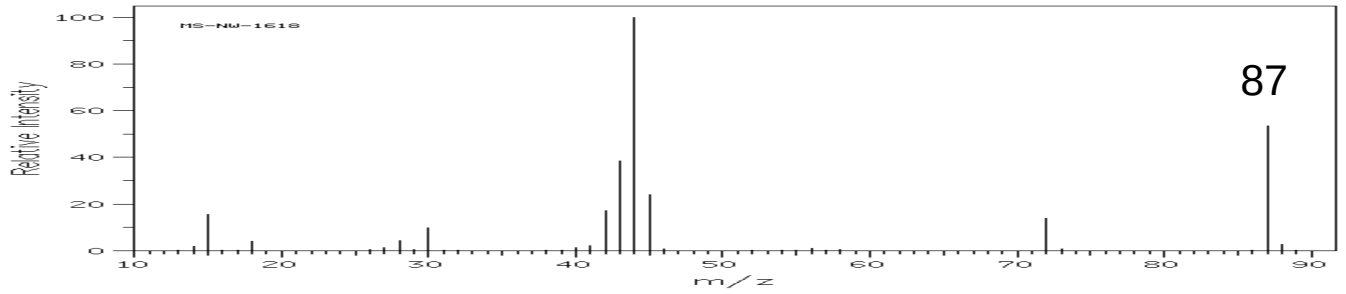
例題2:

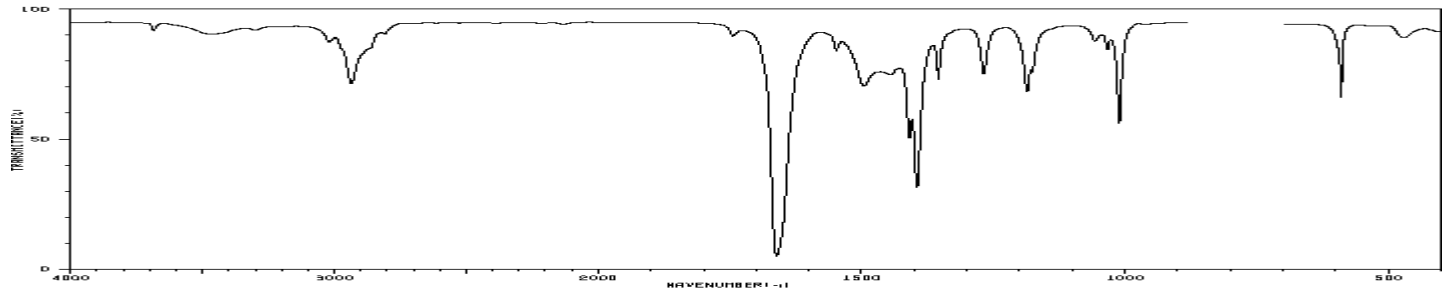

MS-NW-SS01
Relative Intensity
m/z
98

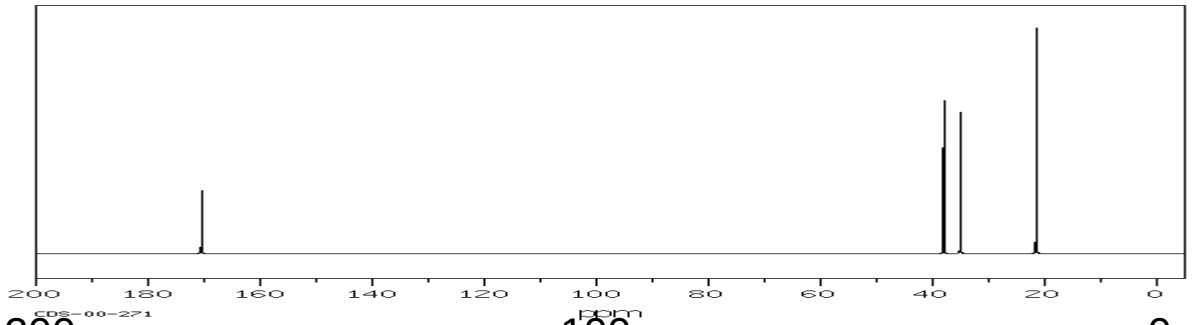

TRANSMITTANCE(%)
WAVENUMBER(-1)
4000
3000
2000
1500
1000
500


200
100
0

例題3:


MS-NW-1618
Relative Intensity
m/z
87


4000
3000
2000
1500
1000
500


200
100
0
ppm