Characteristic Infrared Absorption Frequencies

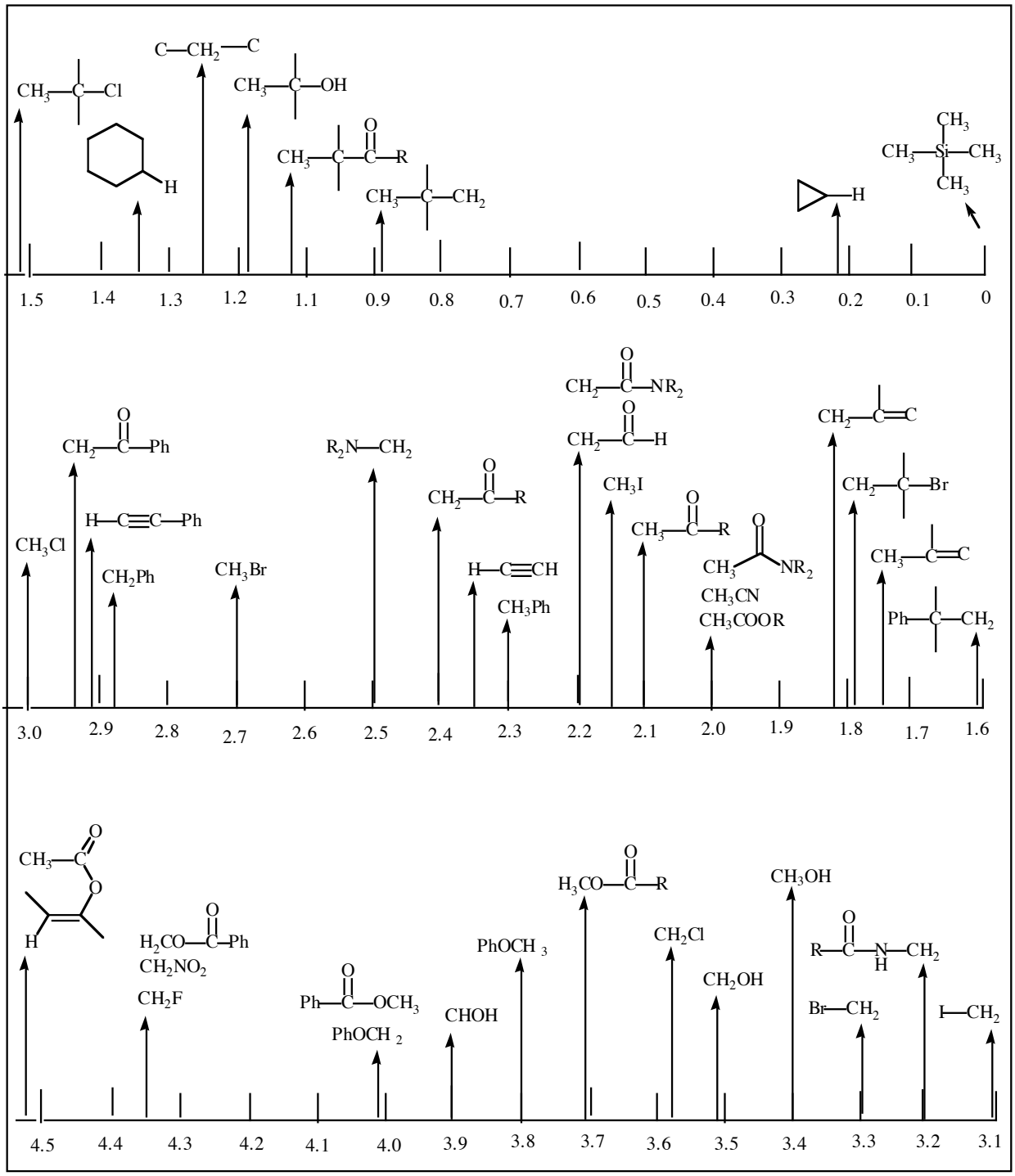
Type of Vibration		Frequency (cm^{-1})	Intensity
C-H			
Alkanes	(stretch)	2980 - 2850	s
$-CH_3$	(bend)	1450 and 1375	m
$-CH_2-$	(bend)	1465	m
Alkenes	(stretch)	3100-3000	m
	(out-of-plane bend)	1000-650	s
Aromatics	(stretch)	3150-3050	s
	(out-of-plane bend)	900-690	s
Alkyne	(stretch)	ca. 3300	s
Aldehyde		2900-2800	w
		2800-2700	m
C-C			
Alkane		Not useful	
C=C			
Alkene		1680-1600	m-w
Aromatic		1600 and 1475	m-w
C,C triple bond			
Alkyne		2250-2100	m-w
C=O			
Aldehyde		1740-1720	s
Ketone		1725-1705	s
Carboxylic acid		1725-1700	s
Ester		1750-1730	s
Amide		1680-1630	s
Anhydride		1810 and 1760	s
Acid chloride		1800	s
C-O			
Alcohols, ethers, esters, carboxylic acids, anhydrides		1300-1000	s
O-H			
Alcohols, phenols			
Free		3650-3600	m
H-bonded		3400-3200	m, broad
Carboxylic acids		3400 - 2400	m, broad
N-H			
Primary and secondary amine And amides			
	(stretch)	3500-3100	m
	(bend)	1640-1550	m-s
C-N			
Amines		1350-1000	m-s
C=N			
Imines and oximes		1690-1640	w-s

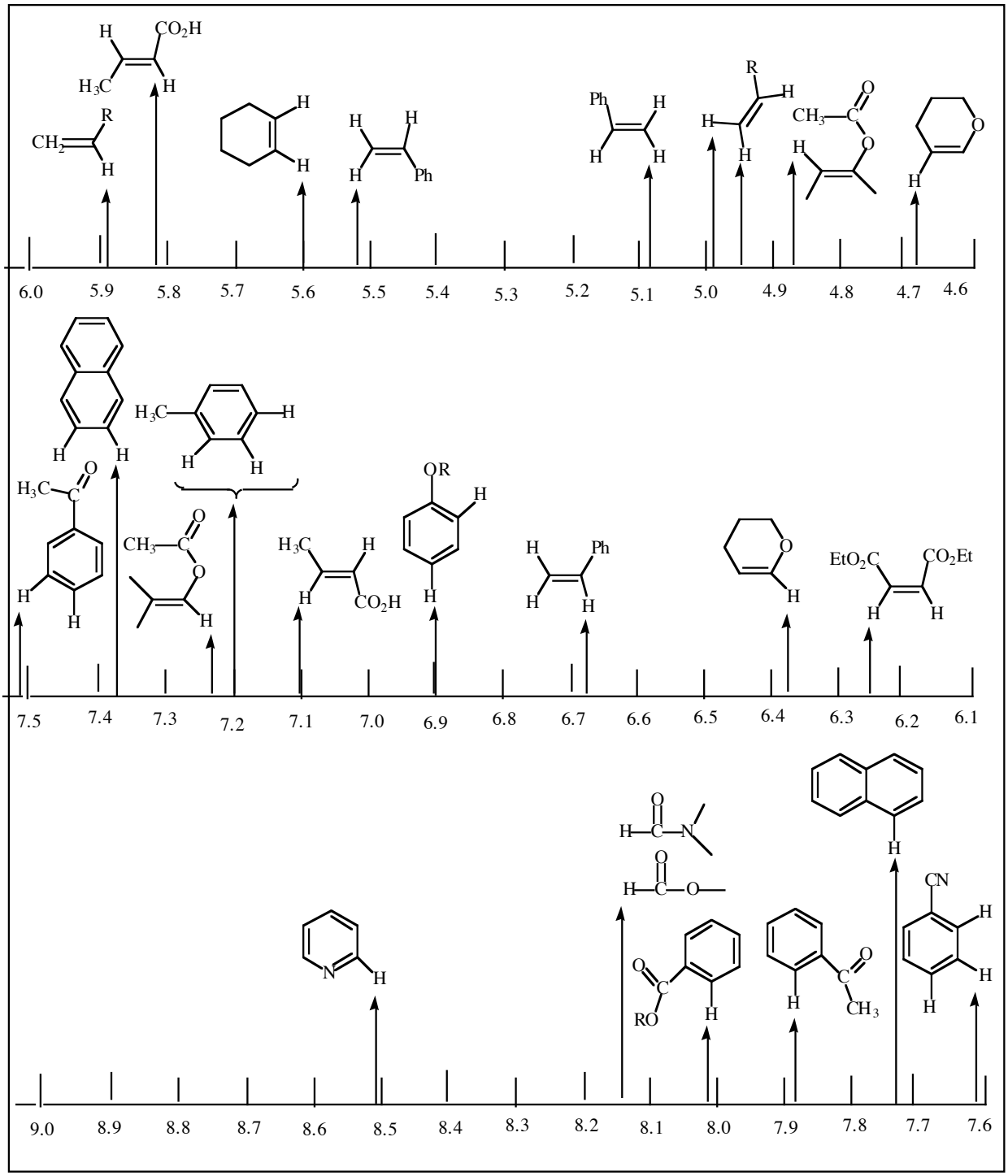
C,N triple bond		
Nitriles	2260-2240	m

Infrared Absorption Frequencies cont'd.

X=C=Y		
Allenes, ketenes, isocyanates, Isothiocyanantes	2270-1940	m-s
N=O		
Nitro (R-NO_2)	1550 and 1350	s
S-H		
Mercaptans	2550	w
S=O		
Sulfoxides	1050	s
Sulfones, sulfonyl chlorides, sulfates, sulfonamides	1375-1300 and 1350-1140	s
C-X		
Fluoride	1400-1000	s
Chloride	785-540	s
Bromide, iodide	< 667	s

Representative ^{1}H Chemical shift Values (ppm)

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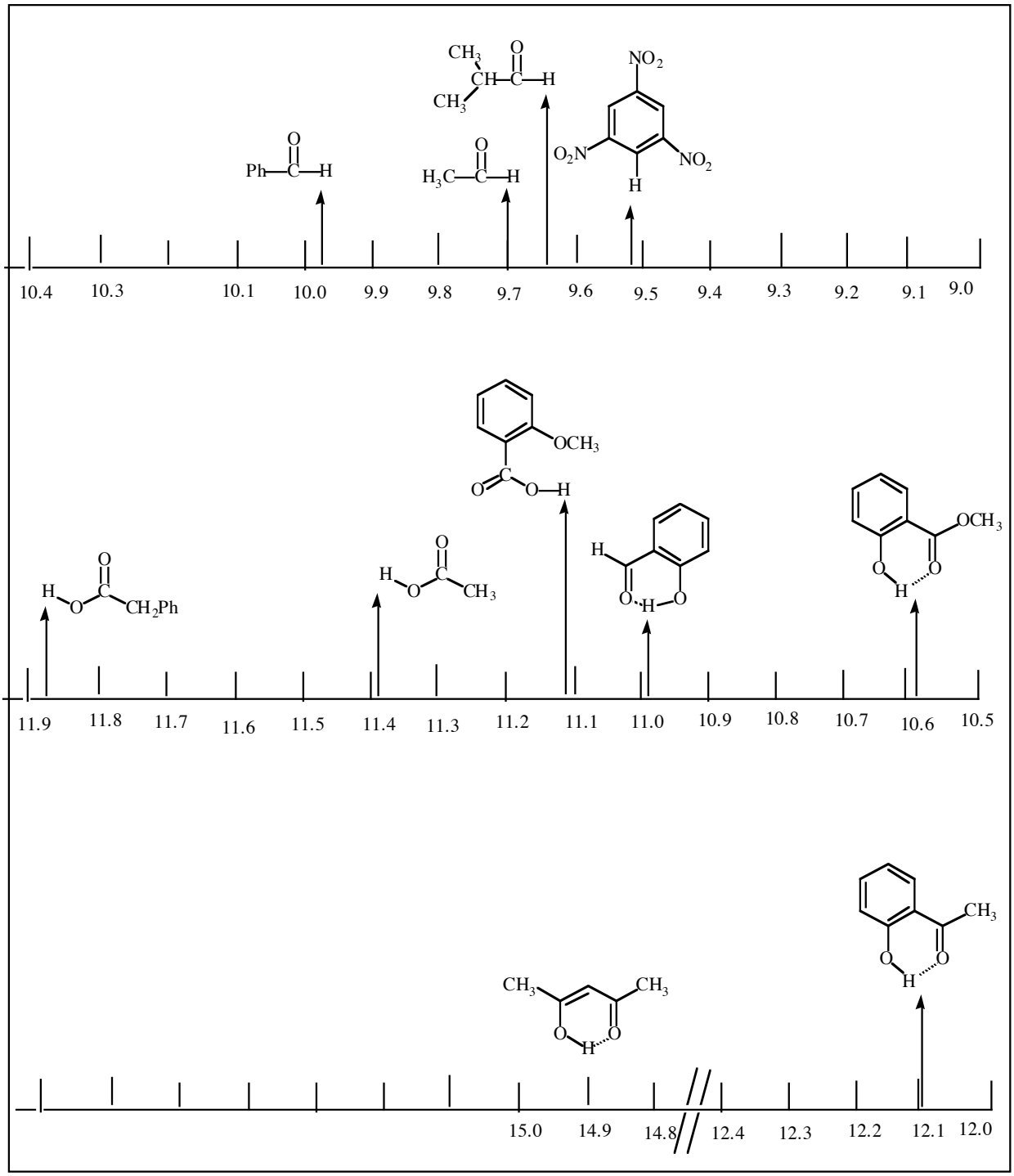
7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5 6.4 6.3 6.2 6.1
9.0 8.9 8.8 8.7 8.6 8.5 8.4 8.3 8.2 8.1 8.0 7.9 7.8 7.7 7.6


CH3
CH
CH3
O
C
H
NO2
O2N
NO2
H
Ph
C
H
O
H3C
C
H
O
10.4
10.3
10.1
10.0
9.9
9.8
9.7
9.6
9.5
9.4
9.3
9.2
9.1
9.0
OCH3
C
O
O
H
H
O
CH2Ph
O
H
O
CH3
O
H
O
H
O
O
H
O
OCH3
O
H
O
11.9
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11.0
10.9
10.8
10.7
10.6
10.5
CH3
O
H
O
CH3
CH3
O
H
O
15.0
14.9
14.8
12.4
12.3
12.2
12.1
12.0