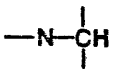
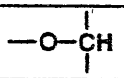
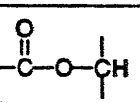
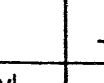
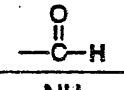
PERIODIC TABLE OF THE ELEMENTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H 1.0																1 H 1.0	2 He 4.0
3 Li 6.9	4 Be 9.0											5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
11 Na 23.0	12 Mg 24.3											13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.5	18 Ar 39.9
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.4	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc 98.0	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 181.0	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po 209.0	85 At 210.0	86 Rn 222.0

Characteristic Infrared Absorptions of Some Functional Groups

Functional Group	Bond	Frequency Range (cm^{-1})	Functional Group	Bond	Frequency Range (cm^{-1})
Alcohol	O-H	3400 - 3650 (s, broad)	Nitrile	C≡N	2210 - 2260 (m)
	C-O	1050 - 1150 (s)	Carboxylic acid	O-H	2500 - 3100 (s, broad)
Ether	C-O	1000 - 1260		C=O	1700 - 1720 (s)
Amine	N-H	3300 - 3500 (m)	Ester	C=O	1710 - 1750 (s)
Alkane	C-H	2850 - 2960 (m - s)	Acyl halide	C=O	1770 - 1820 (s)
Alkene	=C-H	3020 - 3100 (m)	Acid anhydride	C=O	1740 - 1790 (s)
	C=C	1640 - 1680 (m)			1800 - 1850 (s)
Alkyne	≡C-H	3270 - 3330 (s)	Amide	C=O	1630 - 1700 (s)
	C≡C	2100 - 2260 (m)	Aldehyde, ketone	C=O	1680 - 1730 (s)

Characteristic Hydrogen (^{1}H NMR) Chemical Shifts

Type of Hydrogen	Structure	Chemical Shift, δ (ppm)	Type of Hydrogen	Structure	Chemical Shift, δ (ppm)
Reference	$(CH_3)_4Si$	0.00	Amines		2.3 - 3.0
Alkane, primary	$-CH_3$	0.7 - 1.3	Alcohol, ether		3.3 - 4.0
Alkane, secondary	$-CH_2-$	1.2 - 1.4	Ester		3.7 - 4.2
Alkane, tertiary		1.4 - 1.7	Vinyl	C=CH	5.0 - 6.5
Allylic, primary	$C=C-CH_3$	1.6 - 1.9	Aromatic	Ar-H	6.5 - 8.0
Methyl ketone		2.1 - 2.4	Aldehyde		9.7 - 10.0
Aromatic methyl	$Ar-CH_3$	2.5 - 2.7	Amine	$-NH_2$	1 - 5 variable
Alkyne	$-C\equiv CH$	2.5 - 2.7	Alcohol	-OH	1 - 5 variable
Alkyl halide (X = Br, Cl, I)		2.5 - 4.0	Carboxylic acid	-COOH	11.0 - 12.0