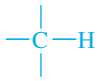
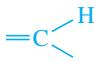
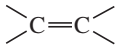
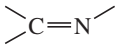
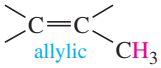
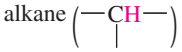
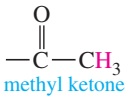
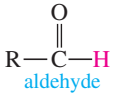
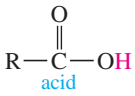
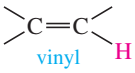
TABLE 12-2 Summary of IR Stretching Frequencies

Frequency (cm^{-1})	Functional Group		Comments
3300	alcohol	O—H	always broad
	amine, amide	N—H	may be broad, sharp, or broad with spikes
	alkyne	≡C—H	always sharp, usually strong
3000	alkane		just below 3000 cm^{-1}
	alkene		just above 3000 cm^{-1}
	acid	O—H	very broad
2200	alkyne	—C≡C—	just below 2200 cm^{-1}
	nitrile	—C≡N	just above 2200 cm^{-1}
1710 (very strong)	carbonyl		ketones, acids about 1710 cm^{-1} aldehydes about 1725 cm^{-1} esters higher, about 1735 cm^{-1} conjugation lowers frequency amides lower, about 1650 cm^{-1}
1660	alkene		conjugation lowers frequency aromatic C=C about 1600 cm^{-1}
	imine		stronger than C=C
	amide		stronger than C=C (see above)

Ethers, esters, and alcohols also show C—O stretching between 1000 and 1200 cm^{-1}.

TABLE 13-3 Typical Values of Chemical Shifts

Type of Proton	Approximate δ	Type of Proton	Approximate δ
alkane ($-CH_3$) methyl	0.9	 allylic	1.7
alkane ($-CH_2-$) methylene	1.3	Ph—H aromatic	7.2
alkane  methine	1.4	Ph—CH_3 benzylic	2.3
 methyl ketone	2.1	 aldehyde	9–10
—C≡C—H acetylenic	2.5	 acid	10–12
R—CH_2—X (X = halogen, O)	3–4	R—OH alcohol	variable, about 2–5
		Ar—OH phenol	variable, about 4–7
 vinyl	5–6	R—NH_2 amine	variable, about 1.5–4

Note: These values are approximate, as all chemical shifts are affected by neighboring substituents. The numbers given here assume that alkyl groups are the only other substituents present. A more complete table of chemical shifts appears in Appendix 1.