

Table E-5. Chemical shifts for carbon atoms in carbon-13 nuclear magnetic resonance spectra.

Type of Carbon Atom	δ^*	Type of Carbon Atom	δ^*	Type of Carbon Atom	δ^*
RCH_2CH_3	13–16	RCH_2NH_2	37–45	$\begin{matrix} \text{O} \\ \parallel \\ \text{CH}_3\text{CR} \end{matrix}$	170–175
RCH_2CH_3	16–25	RCH_2OH	50–64	$\begin{matrix} \text{O} \\ \parallel \\ \text{RCOH} \end{matrix}$	177–185
R_3CH	25–38	$\text{RC}\equiv\text{CH}$	67–70	$\begin{matrix} \text{O} \\ \parallel \\ \text{RCH} \end{matrix}$	190–200
$\begin{matrix} \text{O} \\ \parallel \\ \text{CH}_3\text{CR} \end{matrix}$	~30	$\text{RC}\equiv\text{CH}$	74–85	$\begin{matrix} \text{O} \\ \parallel \\ \text{RCR}' \end{matrix}$	205–220
$\begin{matrix} \text{O} \\ \parallel \\ \text{CH}_3\text{COR} \end{matrix}$	~20	$\text{RCH}=\text{CH}_2$	115–120		
RCH_2Cl	40–45	$\text{RCH}=\text{CH}_2$	125–140		
RCH_2Br	28–35	$\text{RC}\equiv\text{N}$	117–125		
		ArH	125–150		

* The chemical shift values are given in ppm relative to tetramethylsilane (TMS) at δ 0.00 and are for the carbon atoms shown in boldface in the formulas.