

Acidity of Organic Molecules

<u>Functional Group</u>	<u>Acid</u>	<u>Approximate pK_a Values</u> <u>(in water)</u>	<u>Conjugate Base</u> <u>increasing</u> <u>basicity</u>
alkane- sp^3	H-CH_3	48	$\text{}^-\text{CH}_3$
alkene- sp^2	H-CH=CH_2	44	$\text{}^-\text{CH=CH}_2$
amine	H-NH_2	38	$\text{}^-\text{NH}_2$
hydrogen	H-H	35	$\text{}^-\text{H}$
alkyne- sp	$\text{H-C}\equiv\text{CH}$	25	$\text{}^-\text{C}\equiv\text{CH}$
alcohol	H-OCR_3	17	$\text{}^-\text{OCR}_3$
water	H-OH	15.7	$\text{}^-\text{OH}$
thiol	H-SR	10–11	$\text{}^-\text{SR}$
ammonium	$\text{H-}^+\text{NR}_3$	10–11	NR_3
nitrile (cyanide)	$\text{H-C}\equiv\text{N}$	9.2	$\text{}^-\text{C}\equiv\text{N}$
phenol	H-OAr	8–11	$\text{}^-\text{OAr}$
carboxylic acid	H-OC(O)R	4–5	$\text{}^-\text{OC(O)R}$
	H-F	3.17	$\text{}^-\text{F}$
hydronium	$\text{H-}^+\text{OH}_2$	-1.74	OH_2
	H-Cl	-7	$\text{}^-\text{Cl}$
	H-I	-10	$\text{}^-\text{I}$

- Acidity increases across a row: $\text{H-C} < \text{H-N} < \text{H-O} < \text{H-F}$ (electronegativity)
 - Acidity increases down a period: $\text{H-F} < \text{H-Cl} < \text{H-Br} < \text{H-I}$ (size)
 - Neutral species less acidic than corresponding positively charged species: $\text{H-OH} < \text{H-}^+\text{OH}_2$
- pK_a data from: Advanced Organic Chemistry, 4th Ed., J. March