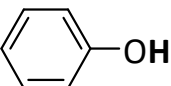
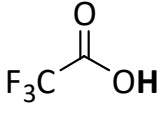
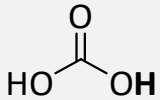
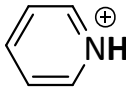
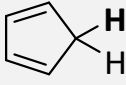
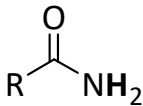


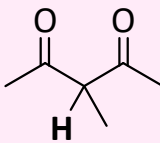
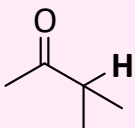
## The Essential pK<sub>a</sub> Values: students should memorize these values on page 1

	Structure	pK <sub>a</sub>	Compound	Notes
strong acid (pK <sub>a</sub> < 0)	HF	3.2	hydrohalic acid	<ul style="list-style-type: none"> <li>Note the periodic table trend: as atom gets larger, acidity increases.</li> <li>Hydrofluoric acid is <b>much</b> less acidic than the other 3.</li> </ul>
	HCl	-7		
	HBr	-9		
	HI	-11		
	H <sub>2</sub> SO <sub>4</sub>	-9	sulfuric acid	<ul style="list-style-type: none"> <li>Depending on your resources, this pK<sub>a</sub> value may be shown as low as -10 and as high as 0.</li> </ul>
	$\begin{array}{c} \oplus \\ \text{OH} \\ \parallel \\ \text{R}-\text{C}-\text{H, R, X} \\ \text{(X = heteroatom)} \end{array}$	between -6 and 0	<i>sp</i> <sup>2</sup> oxonium ion	<ul style="list-style-type: none"> <li>A ⊕-charged oxygen is called an oxonium ion. The pK<sub>a</sub> value is typically between -6 and 0.</li> </ul>
	H <sub>3</sub> O <sup>+</sup> ROH <sub>2</sub> <sup>+</sup> R <sub>2</sub> OH <sup>+</sup>	-2	hydronium ion, protonated alcohol, and protonated ether ( <i>sp</i> <sup>3</sup> oxonium ions)	<ul style="list-style-type: none"> <li>A ⊕-charged oxygen is called an oxonium ion. The pK<sub>a</sub> value is typically between -6 and 0.</li> </ul>
moderate acid (pK <sub>a</sub> 0-7)	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{OH} \end{array}$	5	carboxylic acid (OH attached to carbonyl)	
weak acid (pK <sub>a</sub> 7-14)	HC≡N	9	hydrogen cyanide	
	NH <sub>4</sub> <sup>+</sup> RNH <sub>3</sub> <sup>+</sup> R <sub>2</sub> NH <sub>2</sub> <sup>+</sup> R <sub>3</sub> NH <sup>+</sup>	9-11	protonated <i>sp</i> <sup>3</sup> amine  (ammonium and aminium ions)	<ul style="list-style-type: none"> <li>Do not confuse the protonated amine with the neutral amine.</li> </ul>
		10	phenol (OH attached to benzene)	<ul style="list-style-type: none"> <li>Phenol can be shown as PhOH or C<sub>6</sub>H<sub>5</sub>OH.</li> </ul>
	H <sub>2</sub> O	15.7 (often rounded to 16)	water	
very weak acid, or non-acid (pK <sub>a</sub> > 14)	ROH	16-18	alcohol (OH attached to <i>sp</i> <sup>3</sup> carbon)	<ul style="list-style-type: none"> <li>Do not categorize phenol as an alcohol. Phenol pK<sub>a</sub> is about 10.</li> </ul>
	RC≡CH	24-25	terminal alkyne	
	NH <sub>3</sub> RNH <sub>2</sub> R <sub>2</sub> NH	35-38	neutral <i>sp</i> <sup>3</sup> amine	<ul style="list-style-type: none"> <li>Do not confuse the neutral amine with the protonated amine.</li> </ul>
	H <sub>2</sub>	38	hydrogen gas	
	H <sub>2</sub> C=CH <sub>2</sub>	44	alkene	
	H <sub>3</sub> C-CH <sub>3</sub>	50-60	alkane	

Too many students confuse these two.  
Don't be that student.

## Additional pK<sub>a</sub> Values You Will Likely Encounter

Structure	pK <sub>a</sub>	Compound	Notes
RC≡NH <sup>+</sup>	-10	protonated nitrile	
H <sub>3</sub> PO <sub>4</sub>	2	phosphoric acid	pK <sub>a</sub> 1 = 2; pK <sub>a</sub> 2 = 7.2; pK <sub>a</sub> 3 = 12.4
HN <sub>3</sub>	4.6	hydrogen azide	
	something between -0.3 and 0.3	trifluoroacetic acid (TFA)	
	6.3 (pK <sub>a</sub> 1) 10.25 (pK <sub>a</sub> 2)	carbonic acid	Potassium carbonate (K <sub>2</sub> CO <sub>3</sub> ) is a commonly used base in organic chemistry. The pK <sub>a</sub> of its conjugate acid is 10.25.  K <sub>2</sub> CO <sub>3</sub> is commonly used to deprotonate moderately acidic protons such as phenols (pK <sub>a</sub> ~10) and 1,3-dicarbonyl compounds (pK <sub>a</sub> ~9-13).
	5.2	pyridinium ion	<ul style="list-style-type: none"> <li>This pK<sub>a</sub> value can be used for other sp<sup>2</sup> hybridized protonated amines (&amp; imines).</li> </ul>
H <sub>2</sub> S	7	hydrogen sulfide	
RSH	11	thiol	
	16	cyclopentadiene (sometimes abbreviated CPD)	<ul style="list-style-type: none"> <li>Our most acidic hydrocarbon (similar acidity as water!), the conjugate base becomes aromatic.</li> </ul>
	18-22	amide (1° and 2°)	

	< 16	α-hydrogen of a 1,3-dicarbonyl	<ul style="list-style-type: none"> <li><b>Crucial knowledge</b> when doing enolate chemistry.</li> </ul>
	> 16	α-hydrogen of a monocarbonyl	<ul style="list-style-type: none"> <li><b>Crucial knowledge</b> when doing enolate chemistry.</li> </ul>