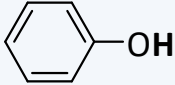


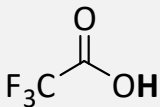
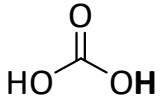
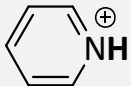
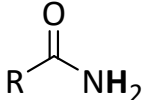
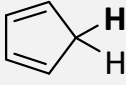
The Essential pK_a Values: students should memorize these page 1 values

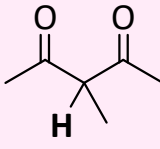
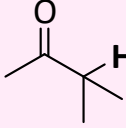
	Structure	pK _a	Compound	Notes
strong acid (pK _a < 0)	HF	3.2	hydrohalic acid	<ul style="list-style-type: none"> Note the periodic table trend: as atom gets larger, acidity increases. Hydrofluoric acid is much less acidic than the other 3.
	HCl	-7		
	HBr	-9		
	HI	-11		
	$\begin{array}{c} \oplus \text{OH} \\ \parallel \\ \text{R} \text{---} \text{C} \text{---} \text{H, R, X} \\ \text{(X = heteroatom)} \end{array}$	between -6 and 0	<i>sp</i> ² oxonium ion	<ul style="list-style-type: none"> A \oplus-charged oxygen is called an oxonium ion. The pK_a value is typically between -6 and 0.
$\begin{array}{l} \text{H}_3\text{O}^+ \\ \text{ROH}_2^+ \\ \text{R}_2\text{OH}^+ \end{array}$	-2	hydronium ion, protonated alcohol, and protonated ether (<i>sp</i> ³ oxonium ions)	<ul style="list-style-type: none"> A \oplus-charged oxygen is called an oxonium ion. The pK_a value is typically between -6 and 0. 	
moderate acid (pK _a 0-7)	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R} \text{---} \text{C} \text{---} \text{OH} \end{array}$	5	carboxylic acid (OH attached to carbonyl)	
	$\begin{array}{l} \text{HC}\equiv\text{N} \\ \text{NH}_4^+ \\ \text{RNH}_3^+ \\ \text{R}_2\text{NH}_2^+ \\ \text{R}_3\text{NH}^+ \end{array}$	9 9-11	hydrogen cyanide protonated <i>sp</i> ³ amine (ammonium and aminium ions)	<ul style="list-style-type: none"> Do not confuse the protonated amine with the neutral amine.
weak acid (pK _a 7-14)		10	phenol (OH attached to benzene)	<ul style="list-style-type: none"> Phenol can be shown as PhOH or C₆H₅OH.
	$\begin{array}{l} \text{H}_2\text{O} \\ \text{ROH} \end{array}$	15.7 (often rounded to 16) 16-18	water alcohol (OH attached to <i>sp</i> ³ carbon)	<ul style="list-style-type: none"> Do not categorize phenol as an alcohol. Phenol pK_a is about 10.
	$\begin{array}{l} \text{RC}\equiv\text{CH} \\ \text{NH}_3 \\ \text{RNH}_2 \\ \text{R}_2\text{NH} \end{array}$	24-25 35-38	terminal alkyne neutral <i>sp</i> ³ amine	<ul style="list-style-type: none"> Do not confuse the neutral amine with the protonated amine.
	$\begin{array}{l} \text{H}_2 \\ \text{H}_2\text{C}=\text{CH}_2 \\ \text{H}_3\text{C}-\text{CH}_3 \end{array}$	38 44 50-60	hydrogen gas alkene alkane	
very weak acid, or non-acid (pK _a > 14)				

Too many students confuse these two.

Don't be that student.

Additional pK_a Values You Will Likely Encounter

Structure	pK _a	Compound	Notes
RC≡NH ⁺	-10	protonated nitrile	
H ₂ SO ₄	-3	sulfuric acid	<ul style="list-style-type: none"> Depending on your resources, this pK_a value may be shown as low as -10 and as high as 0.
H ₃ PO ₄	2	phosphoric acid	
HN ₃	4.6	hydrogen azide	
	0.2	trifluoroacetic acid (TFA)	
	6.3	carbonic acid	
	5.2	pyridinium ion	<ul style="list-style-type: none"> This pK_a value can be used for other sp² hybridized protonated amines (& imines).
H ₂ S	7	hydrogen sulfide	
RSH	11	thiol	
	15	amide (1° and 2°)	
	16	cyclopentadiene (sometimes abbreviated CPD)	<ul style="list-style-type: none"> Our most acidic hydrocarbon (similar acidity as water!), the conjugate base becomes aromatic.

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